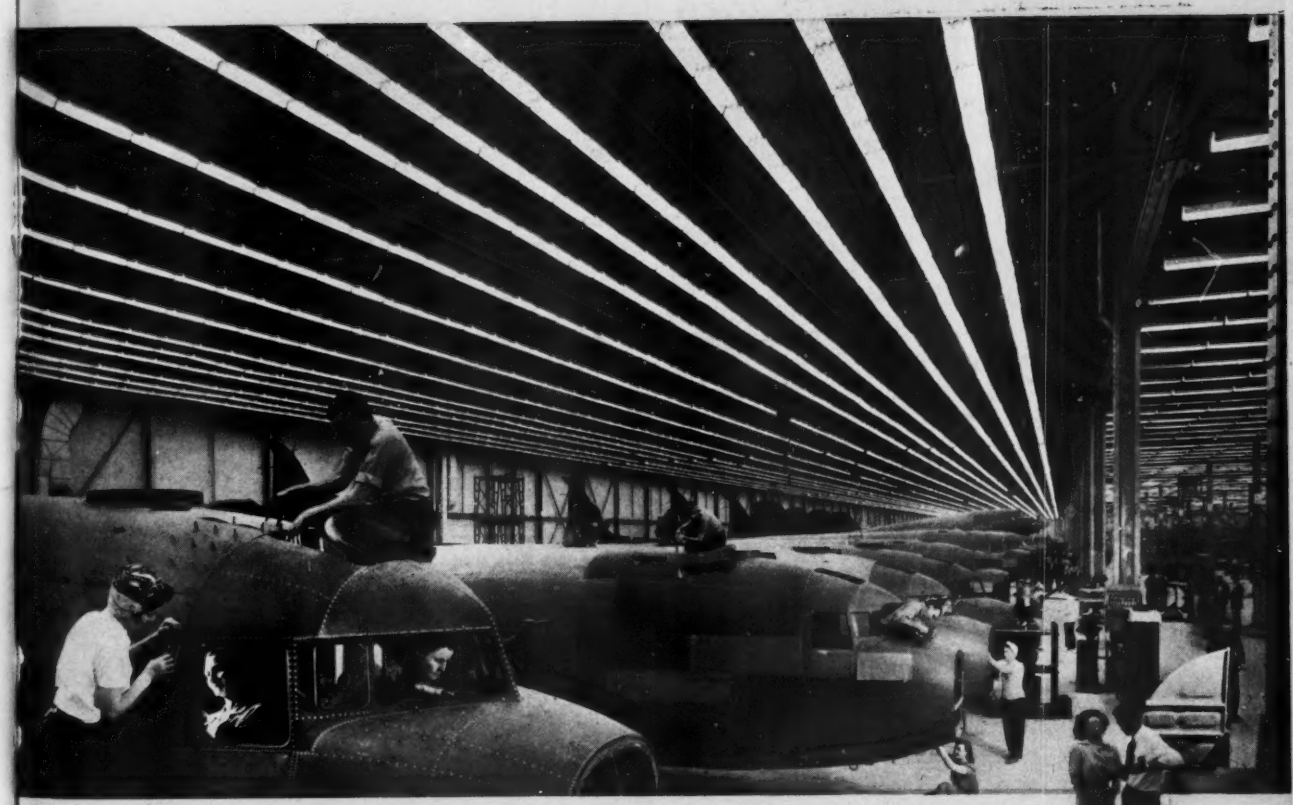
Electrical Contracting

The Magazine of

ELECTRICAL CONSTRUCTION AND MAINTENANCE



Douglas Skytrains assembled under 55 foot-candles from non-metallic reflectors in this Austin built windowless plant. "Non-Critical Supports" illustrates wiring methods using minimum critical materials. Page 35.

MAY 1943

INDUSTRIAL ELECTRIFICATION SECTION

Pages 63-74

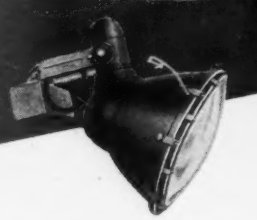
UMI

NEED FLOODLIGHTS IN A HURRY?

HERE THEY ARE— DELIVERY IN 2 WEEKS*

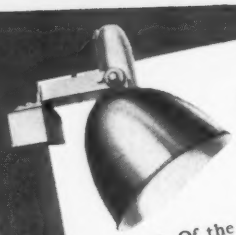
Type L-66—200 watts

This handy floodlight has wide-beam light distribution for close-range floodlighting. The reflector, of die-formed steel, light in weight but able to stand up under the roughest handling, is mounted on a low, circular base-and-stand that is easily concealed and easily handled. All steel and iron parts have a rust-resisting finish. The door glass and gasket rest on the flanged rim of the housing and are held in place by a steel ring and screw. Slip-fitter, 2-inch pipe top, and ground-spike mountings are also available.



TYPE L-45 and TYPE L-46—300-1500 watts

Here are two floodlights that provide wide-angle light for illuminating large ground areas. They are usually mounted on poles within or near the area to be lighted. Of the two, the L-46 supplies a wider and flatter beam range. For longer range, or emphasis on certain objects, auxiliary internal reflectors are available. The main reflectors are die-formed steel in two designs, as illustrated. Porcelain-enamel finished inside and out, they are dark green on the outside and have a double coat of white on the reflecting surface. Available with four types of mountings: crossarm bracket, oval base, 1- to 2-inch pipe clamp; or 1½- or 2-inch pipe slip-fitter. These light and flexible floodlights offer an easy, simple method of effective outdoor floodlighting for small installations and such purposes as gate-lighting for war plants.



TYPE L-68—1500 watts

To provide durability and strength with efficiency this floodlight has a steel housing with an inner silvered-glass reflector. Strong and light, it is designed for ease of installation and servicing. Optional, steel reflectors are available for either narrow- or wide-beam light distribution. An asbestos gasket between reflector and housing makes the floodlight completely weatherproof. All iron and steel parts have a rust-resistant finish, including external, dark-green paint. The cover-glass is clear, convex, heat-resistant Pyrex, 18 inches in diameter. A number of mountings are available: crossarm; oval base; 1½-, 2-, 2½-inch pipe slip-fitter; 1- to 2-inch, or 2½- to 3½-inch pipe clamp; or 1½- to 2-inch pipe top. This floodlight has been designed for permanent installation and long service with minimum servicing.

TYPE L-43—750/1000 watts; TYPE L-49—300/500 watts

These general utility floodlights are of silvered glass—one of the best commercial light-reflecting surfaces available. The door glass is clear, convex, and heat-resistant, and a clamping ring holds it against the gasket on the reflector rim, making the floodlights weatherproof. The reflector itself, although glass, will not break except under an exceptionally severe blow; even then it will not shatter because the pieces are held in place by the extra-heavy protective coating of electrolytically deposited metal. Reflector and socket housing are dark green. All steel and iron parts have rust-resistant finish painted the same green. Both floodlights are available with four mountings: crossarm bracket; oval base; 1- to 2-inch pipe clamp; or 1½- or 2-inch pipe slip-fitter.

*Based on careful survey of present factory conditions and performance.

WHERE TO ORDER:
Place your order with our nearest office, or write General Electric, Schenectady, N. Y.

GENERAL ELECTRIC

451-67-3200

"WE BUY 'EM FOR SERVICING FLUORESCENTS—

—and now every mechanic grabs 'em!"

•

Such FLEXIBILITY in REACH, HEIGHT and MOBILITY makes this the SAFEST, FASTEST MAINTENANCE LADDER ever known

•

You tell us the height and side-ways reach you need and your minimum aisle width—then we'll come back with data on the *one* ladder that will do the safest, fastest, most satisfying service that money can buy. Relamping need not interfere with production. Metropolitan Device Corporation, Brooklyn, N. Y.

Send for the full story in pictures!

METROPOLITAN DEVICE CORPORATION

Brooklyn, N. Y.

Murray crow's nest

Send me data (without obligation) on the Murray Crow'snest best suitable for our requirements. Our ladder must reach_____ feet high and extend_____ feet side-ways. Aisle width is_____ feet.

NAME and TITLE_____

COMPANY_____

ADDRESS_____

ELECTRICAL CONTRACTING. Published monthly, price 25 cents a copy, Vol. 42, No. 5. Allow at least ten days for change of address. RETURN POSTAGE GUARANTEED. All communications about subscriptions should be addressed to the Director of Circulation, Electrical Contracting, 330 West 42nd St., New York, N. Y. Subscription Rates—U. S. A., and Latin-American Republics, $2.00 a year, $3.00 for two years, $4.00 for three years. Canada $2.50 a year, $4.00 for two years, $5.00 for three years. Great Britain and British Possessions 18 shillings for one year, 36 shillings for three years. All other countries $3.00 a year; $6.00 for three years. Entered as second-class matter August 29, 1936, at Post Office, Albany, N. Y., under the Act of March 3, 1879. Printed in U. S.

Copyright 1943 by McGraw-Hill Publishing Company. Cable address: "McGraw hill, New York." Member A. B. P. Member A. B. C.

FIRST Explosion-Proof FLUORESCENT LIGHTING

FOR EVERY HAZARDOUS LOCATION!

APPLETON FLUORESCENT EQUIPMENT IS COMPLETE

"GRU" Series Explosion-Proof Flanged Ceiling Unilet With Fixture Canopy—

Type "LSH" Ceiling Support for Blind or Dummy End — Spans Line Conduit

Type "UNY" Explosion-Proof Union Connectors — Fit End Castings of Fixture, Facilitate Mounting

APPLETON ELECTRIC PRODUCTS

LISTED UNDER REEXAMINATION SERVICE UL OF UNDERWRITERS LABORATORIES

APPROVED BY UNDERWRITERS' LABORATORIES

Skillfully designed, ruggedly built to meet all code requirements for hazardous locations, Appleton Explosion-Proof Fluorescent Lighting Fixtures now are listed and approved by Underwriters' Laboratories for Class I, Groups C and D; and Class II, Groups F and G, installation.

Thus Appleton engineering leadership safely provides all advantages of modern fluorescent lighting in oil refineries, powder mills, chemical plants, airplane-plant paint and lacquer departments, hospital operating rooms and grain elevators—in thousands of installations where good lighting can aid tremendously in the war effort, yet where danger of explosion must be carefully safeguarded.

Expertly engineered for convenient installation and quick, easy lamp renewals. No external seals are necessary. Designed for two 48-inch, 40-watt, T-12 lamps, which are completely enclosed in genuine Pyrex tubes. Appleton auxiliary fittings, shown at left, simplify safe, workmanlike installation.

This recent and exclusive Appleton development opens a new field of wartime industrial lighting. Check the hazardous locations in your community, NOW!

Sold Through Wholesalers

APPLETON ELECTRIC COMPANY

1704 WELLINGTON AVENUE • CHICAGO, ILLINOIS

Branch Offices: NEW YORK, 76 Ninth Avenue • DETROIT, 7310 Woodward Avenue • CLEVELAND, 1836 Euclid Avenue • SAN FRANCISCO, 655 Minna Street • ST. LOUIS, 420 Frisco Bldg. • LOS ANGELES, 100 North Santa Fe Avenue • ATLANTA, 175 Luckie Street, N. W. • BIRMINGHAM, 6 N. Twenty-first Street • MINNEAPOLIS, 305 Fifth Street, S. • PITTSBURGH, 418 Bessemer Bldg.

Resident Representatives: Baltimore, Boston, Cincinnati, Dallas, Denver, Kansas City, Milwaukee, New Haven, New Orleans, Philadelphia, Seattle

APPLETON

UMI

Electrical Contracting

WITH WHICH IS CONSOLIDATED THE ELECTRAGIST AND ELECTRICAL RECORD—ESTABLISHED 1901

A practical technical and management journal for electrical contractors, industrial electricians, inspectors, engineers and motor shops, covering engineering, installation, repairing, maintenance and management, in the field of electrical construction and maintenance.

CONTENTS • MAY, 1943

Management Service—*An Editorial* 33

Non-Critical Supports 35

By C. W. BURNEY—High tension distribution, wood structures, open wiring and non-metallic lighting units saved tons of copper and steel at this new airplane plant.

Emergency Wires 38

By L. C. NEUMANN—The uses and limitations of the new wire insulations in interior wiring systems is outlined by Underwriters' Laboratory engineers.

Labor Burden as a Cost 39

By RAY W. ASHLEY—Showing how the supplying and managing labor costs vary with type and volume of work.

Advantages of Increased Voltage 40

By R. E. MILLER—Shows how increased voltage will give greater starting torques and more economical lighting while increasing system load capacity.

Estimating Special Boxes and Troughs 42

By LEO WITZ—A method of approximating costs which recognizes that actual installation time is only a part of the job labor costs on special boxes.

Steel as Substitute A.C. Conductors 43

By STANLEY C. KILLIAN and ALLAN A. ALSAKER—Laboratory tests and investigation of steel substitutes for copper conductors led to the development of current carrying capacities for steel pipe and structural shapes.

Editorials 46

Industrial Electrification—*A Feature Section* 63

Power Factor Improvement

Departments

Methods 48
Motor Shops 56
Reader's Quiz 70
Questions on the Code 77
Modern Lighting 82
Equipment News 90
In the News 100
Priorities 126
Advertisers' Index 140

W. T. Stuart ..... Editor
Alice McMullen ..... Associate Editor
August Eckel ..... Middle West Editor
W. A. Cyr ..... Pacific Coast Editor
R. E. Miller ..... Industrial Editor
Harry Phillips ..... Art Editor

W. K. Beard, Jr. ..... Publisher
M. S. MacNaught ..... Manager

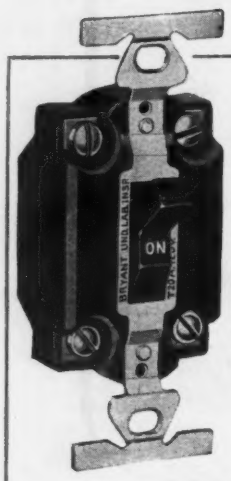
District Managers
S. A. Jones ..... New York
F. J. Seiler ..... Cleveland
W. B. Heaps ..... Chicago
A. B. Conklin, Jr. ..... On leave, U. S. Army

McGRAW-HILL PUBLISHING COMPANY, INC.

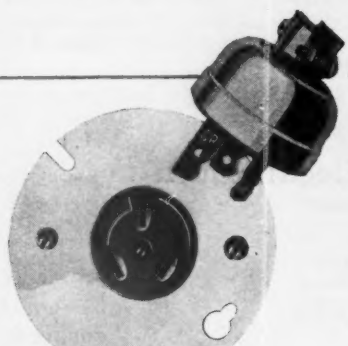
JAMES H. McGRAW, Founder [illegible] Honorary Chairman; James H. McGRAW, Jr., President; HOWARD EHRLICH, Executive Vice-President; MASON BRITTON, Vice-President; B. R. Putnam, Treasurer; JOSEPH A. GERARDI, Secretary; T. BLACKBURN, Jr., Director of Circulation. *Branch Offices:* [illegible] North Michigan Ave., Chicago; 68 Post St., San Francisco; Aldwych House, Aldwych, London, W. C. 2; Washington; Philadelphia; [illegible]land; Detroit; St. Louis; Boston; Atlanta; Los Angeles. Member [illegible] Member A. B. P. Publication Office, 99-129 North Broadway, [illegible]ay, N. Y. Editorial and Executive Offices. 330 W. 42nd St., New York, N. Y.

Bryant heavy duty wiring devices

Bryant industrial devices have that extra ruggedness to stand up under war time production conditions. Bryant switches, sockets, outlets, fluorescent starters and devices can all be depended upon to do their job on the production front.



SHALLOW 20-AMPERE FLUSH SWITCH NO. 5862 is made to withstand the continuous use required in industrial service today. The mechanism is enclosed in rugged bakelite. The handle is made of a special unbreakable plastic. New type mechanism insures trouble-free service. U.L. "T" rated. Conforms to Federal Specifications.



20-AMPERE 3-WIRE OUTLET NO. 9324 AND NO. 9322 PLUG for grounding and for providing electrical service to industrial equipment. Long grounding prong on PLUG assures safe grounding. Extra heavy double-sided contacts insure positive register.

NO-BLINK STARTER FS4-NA provides perfect starts and also stops blinking immediately when the lamp becomes deactivated. When a worn out lamp is replaced, the starter functions at once—automatically.

SOLD THROUGH ELECTRICAL WHOLESALERS

THE BRYANT ELECTRIC COMPANY

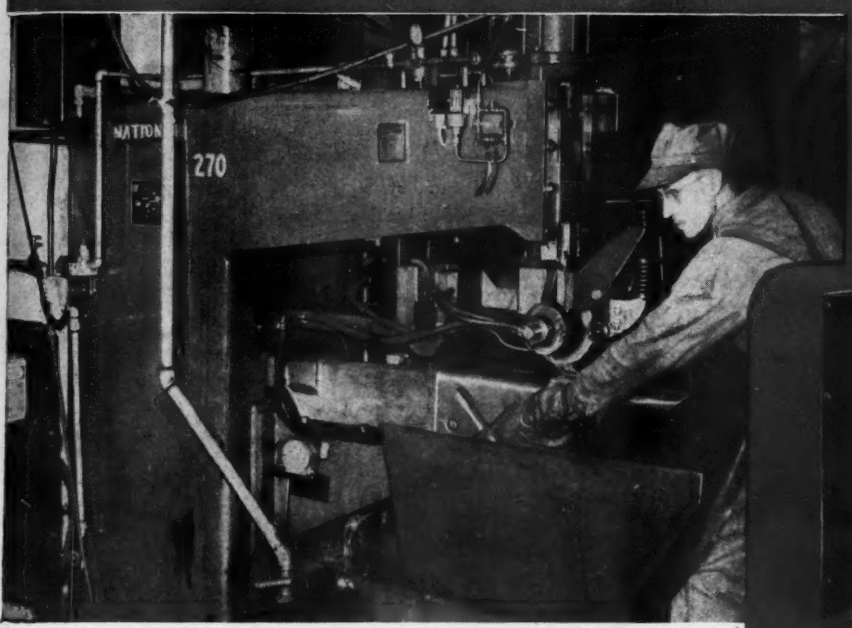
BRIDGEPORT, CONNECTICUT

BRYANT
SUPERIOR WIRING DEVICES

UMI

TO REDUCE KVA DEMAND OF RESISTANCE WELDERS

USE G-E PYRANOL CAPACITORS



Series-capacitor equipment for improving power factor of resistance-welding machines

The Conco Engineering Works, Mendota, Ill., reduced the kva demand of this welder from 150 kva to 54.6 kva by installing series capacitors (partly shown at left). A serious wiring and power-factor problem within the factory was solved, and a bad light flicker in town was eliminated. The capacitors added only 14 per cent to the installed cost of the welder.

PROBLEM

Welding loads present a problem to both resistance-welding machine users and utility companies. First, because the power demand is high, and the power factor is low. Second, the load is single phase, causing unbalance on polyphase systems. Third, the duty is highly intermittent, causing light flicker.

SOLUTION

Capacitors can be used in series with the primary of the welding transformer to reduce kva demand from the line by improving power factor to approximately unity.

RESULTS

- **More welding machines can be used on an existing feeder.**
- **Heavier welds are possible on the feeders where capacitors have been installed.**
- **Reduced interference with other welders on the same feeder.**
- **Welding machines can be installed on feeders too small to supply the usual low-power-factor machines.**
- **Removal or lessening of the restrictions sometimes imposed by power companies.**
- **Reduction of light flicker.**
- **Smaller feeder and power-supply equipment are needed for new welders.**
- **The necessity of running a separate feeder for a welder can probably be avoided.**
- **Special, low-impedance, power-supply transformers are not necessary.**
- **Long-throat machines will have practically the same kilowatt demand as short-throat machines.**

Application information can be obtained by asking for Bulletin GET-1134. For specific recommendations call your G-E representative. He'll be glad to help you. General Electric, Schenectady, N. Y.

GENERAL ELECTRIC

407-54-5700

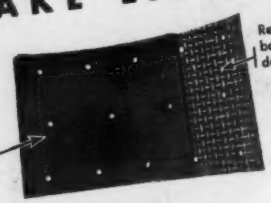
WAGNER
Crane Brake MAINTENANCE

No matter what your crane bridge brake requirements may be, you can look to Wagner for complete hydraulically actuated bridge braking systems for either new cranes or for conversion from mechanical brakes.

Wagner hydraulically actuated bridge braking systems come in two types—type H for inside cranes and type HM for outside cranes where automatic parking attachment is necessary.

A few of the many points of excellence of Wagner hydraulic bridge braking systems are: **1.** Easy one-point adjustment . . . **2.** Exclusive anti-drag device . . . **3.** They have hardened pins, knurled to prevent rotation . . . **4.** They have bushings at points of maximum wear . . . **5.** Grease fittings are provided on all hinge pins . . . **6.** The friction blocks are extra thick, and bolted to the shoes . . . **7.** Wagner provides nation-wide service through twenty-five branches.

BRAKE LINING . .



Preformed in blocks to fit all makes and sizes of crane brakes.

Wagner molded wire-backed blocks have the following advantages: **1.** Non-abrasive—will not score brake wheels . . . **2.** Suitable for use with any type of brake wheel . . . **3.** Preformed to size and molded to wheel diameter . . . **4.** Wire-backed to permit deep seating of lining bolts or rivets . . . **5.** Molded blocks save installation time because they are easily applied . . . **6.** Available from Wagner branch stock . . . **7.** They reduce inventory by eliminating excessive stocks of roll-type lining which is generally purchased in long lengths in order to obtain the best price.

WAGNER HYDRAULIC BRIDGE BRAKING SYSTEM
. . . Complete—Ready to Install on New or Old Cranes

The complete system includes everything necessary—brake assembly, brake wheel, master cylinder, wheel cylinder, tubing, flexible hose, brake fluid, and all fittings.

Brake Wheel furnished with bore as specified.

Brake Assembly—Type H illustrated is for inside cranes. Type HM for outside cranes.

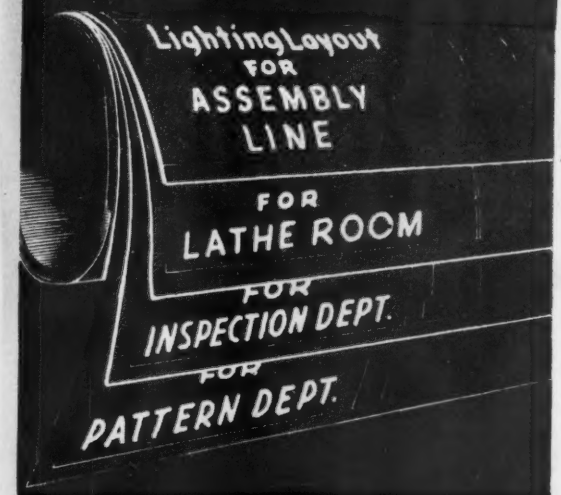
Send Today for Complete Information!

143-2

Wagner Electric Corporation
6400 Plymouth Avenue, Saint Louis, Mo., U.S.A.

BRIDGE BRAKES • TRANSFORMERS • MOTORS

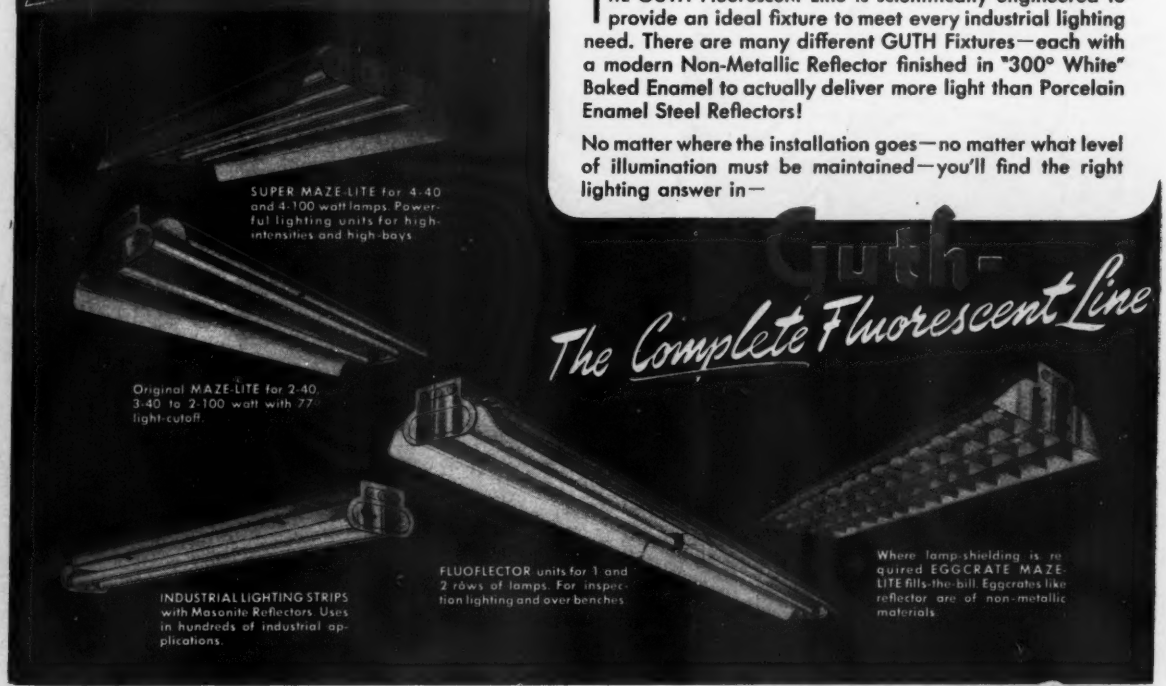
for EVERY Industrial Lighting Need



There's An Efficient Guth Fluorescent FIXTURE!

THE GUTH Fluorescent Line is scientifically engineered to provide an ideal fixture to meet every industrial lighting need. There are many different GUTH Fixtures—each with a modern Non-Metallic Reflector finished in "300° White" Baked Enamel to actually deliver more light than Porcelain Enamel Steel Reflectors!

No matter where the installation goes—no matter what level of illumination must be maintained—you'll find the right lighting answer in—


SUPER MAZE-LITE for 4-40 and 4-100 watt lamps. Powerful lighting units for high-intensities and high-bays.
Original MAZE-LITE for 2-40, 3-40 to 2-100 watt with 77° light-cutoff.
INDUSTRIAL LIGHTING STRIPS with Masonite Reflectors. Uses in hundreds of industrial applications.
FLUOFLECTOR units for 1 and 2 rows of lamps. For inspection lighting and over benches.
Where lamp-shielding is required EGGCRATE MAZE-LITE fills-the-bill. Eggcrates like reflector are of non-metallic materials.

Guth—
The Complete Fluorescent Line

★ ★ ★ ★ ★ ★ ★ ★

Leaders in Lighting Since 1902 **Guth**

★ ★ ★ ★ ★ ★ ★ ★

THE EDWIN F. GUTH CO. • 2615 Washington Ave. • St. Louis, Mo.

FOR CORROSIVE LOCATIONS. These oil-immersed combinations are made in two forms —for both corrosive and hazardous locations.
DUST-TIGHT COMBINATIONS. Available through NEMA size 5—these starters are for application in dusty locations
NEW HIGH-VOLTAGE COMBINATION. This provides split-cycle short-circuit protection and starting means for high-voltage motors.

GENERAL ELECTRIC

670-93C-8490

UMI

HEY BILL!
YOU'RE DOUBLING YOUR WORK WHEN YOU INSTALL CONTROL THAT WAY!
EVER HEAR OF G-E COMBINATION MOTOR STARTERS?
BY using G-E combination starters, you can cut the time required to install motor control by 50 per cent. That's because "combinations" combine two controls—a motor-circuit switch (with short-circuit protection) and a magnetic starter—in one, compact, easy-to-mount unit.
But that isn't all—combination starters save critical material by eliminating unnecessary conduit; and they offer your operators better protection because the case door is interlocked with the safety switch.
Save man-hours and critical material by specifying General Electric combination starters. General Electric Company, Schenectady, N. Y.
WATERTIGHT COMBINATIONS For outdoor application and for installation in damp locations.
FOR HAZARDOUS LOCATIONS Enclosed in a high-strength, alloy case, these starters are ideal for Class 1, Group D, locations.
FOR GENERAL-PURPOSE USE These combinations are for indoor applications where atmospheric conditions are normal.
OMBINATION STARTERS FOR MOTORS FROM 1 TO 1000 HP

UMI

THIS BULLETIN...

Is the Most Comprehensive Ever Published on

Varnished Cambric Insulated Cables

Varnished cambric insulated wires and cables are ideally suited for numerous electrical applications.

The valuable information contained in this Bulletin should be in the hands of every man who has a part in installing, maintaining or buying insulated wires and cables for every electrical operation. It will tell him how varnished cabric insulated wires and cables will adequately and safely fill his requirements, and at the same time save critical war materials. A bound-in supplement gives consideration for increased loading under wartime conditions.

Bulletin OK-1013, just off the press, is the most comprehensive ever published on varnished cambric insulated wires and cables and shows in detail: Specification and test data – Underwriters' (N.E.C.) approvals – Shielding – Application range – Selector Chart – Protective coverings – Conductor designs – Construction data – Current-carrying capacities, 1 – in underground ducts, 2 – in conduit, 3 – in air, 4 – buried in earth.

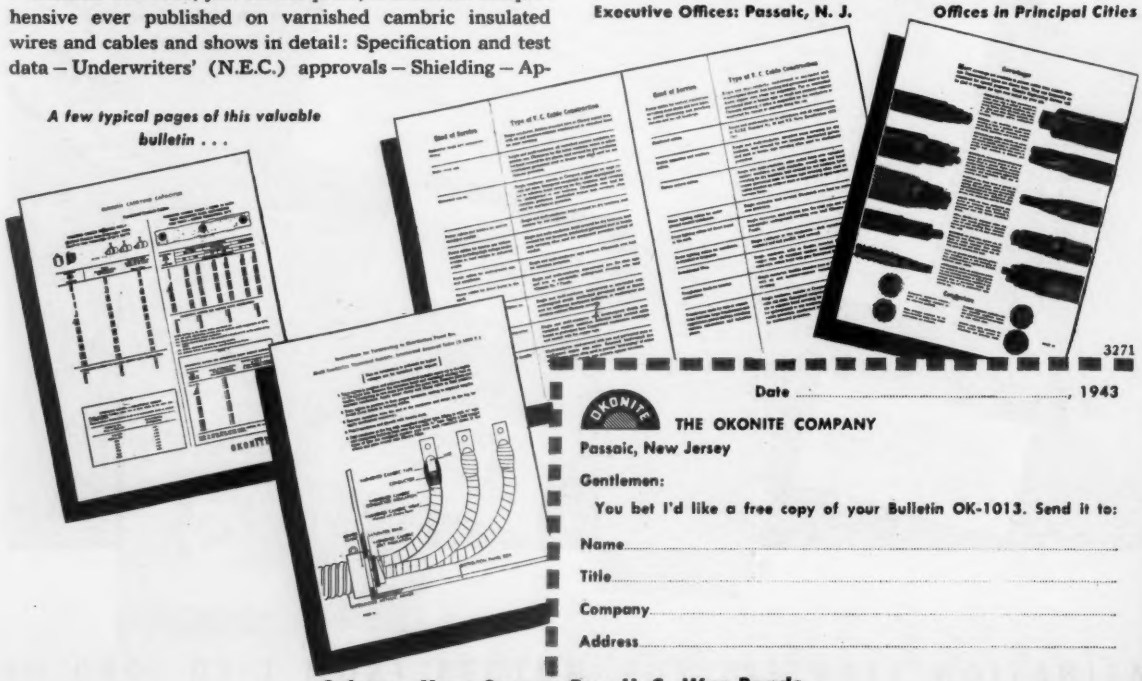
Correction factors for segmental conductors, non-metallic conduit and d.c. ratings – Voltage drop tables – Conduit capacities – Splicing instructions – Terminating without pot-heads – Essential purchase data, etc.

To get your **FREE** copy of this valuable Bulletin, fill out and mail the attached coupon *now*.

THE OKONITE COMPANY

Executive Offices: Passaic, N. J. **Offices in Principal Cities**

A few typical pages of this valuable bulletin . . .



3271

Date ....., 1943

OKONITE THE OKONITE COMPANY

Passaic, New Jersey

Gentlemen:

You bet I'd like a free copy of your Bulletin OK-1013. Send it to:

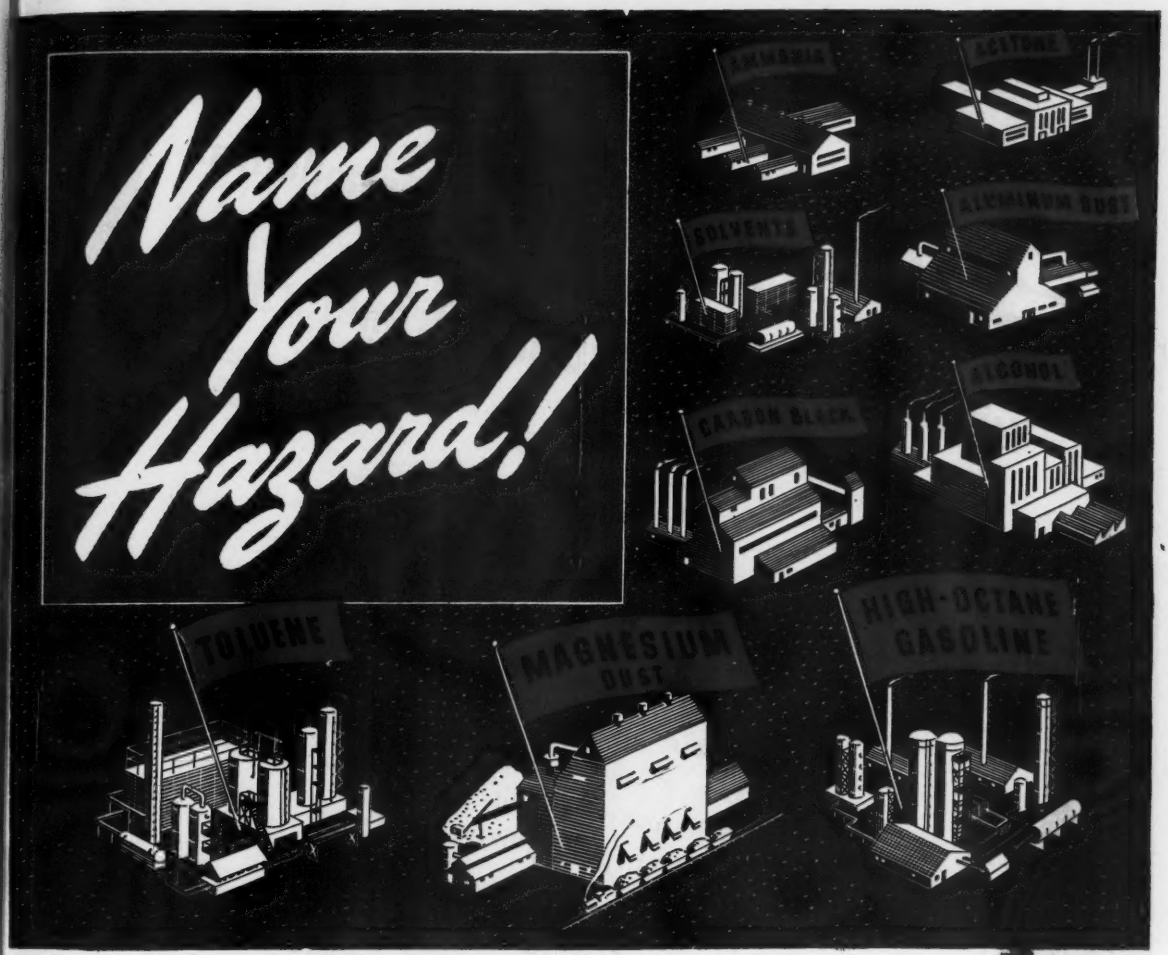
Name.....

Title.....

Company.....

Address.....

Salvage Your Scrap—Buy U. S. War Bonds



THERE'S A G-E EXPLOSION-PROOF MOTOR TO MEET IT

No one type of motor is "best" for all kinds of hazardous locations. The *right* selection may eliminate the need for fire-walls to isolate the motor, and for awkward remote-drive arrangements.

Our engineers offer to work with you to select the motor, control, and other auxiliary equipment that best combines simplicity with security on the job.

General Electric builds the most complete line of explosion-proof and dust-tight motors available, tested and listed by Underwriters' Laboratories, Inc., for specific industrial hazards.

Most of these motors are as compact as standard open types, and require even less maintenance because of their totally enclosed construction.

Information on motorizing equipment in hazardous places is given in our publication No. GEA-3647. For this or any other motor assistance that can help speed war production, just call your General Electric Representative. Or write *General Electric, Schenectady, N. Y.*

Three More G-E "FIRSTS" in Motors for Hazardous Places

EXPLOSION-PROOF TO 600 HP

Totally enclosed squirrel-cage motors up to 600 hp are now listed by Underwriters' Laboratories, Inc., for Class I, Group D, locations, where atmospheres may contain gasoline, petroleum vapors, acetone, alcohols, natural gas.

TESTED AND LISTED FOR COMBUSTIBLE DUSTS

Built in a wide range of types and sizes, this motor is U.L.-listed for Class II, Group F, locations—where coal dust, coke dust, or carbon black may be present.

FOR METAL DUSTS LIKE MAGNESIUM, ALUMINUM

Ordnance plants find wide application for this totally enclosed motor, tested and listed by Underwriters' Laboratories for Class II, Group E, locations.

GENERAL ELECTRIC

750-197-8030

Simplify transformer installations with all-purpose Pyranol transformers

From the one fact that Pyranol* won't burn spring many benefits that would otherwise be difficult to obtain. Since you don't need expensive, fireproof vaults, you can install Pyranol transformers anywhere you wish—in the basement, on overhead beams, on the roof, or on the factory floor *at the center of the load*. Load-center distribution is highly desirable today because of the great savings in secondary copper that it makes possible. (Also, power losses are less and voltage regulation is 40 per cent better in the usual case.)

And whether the location you choose is indoors or outdoors, above ground or underground, wet or dry, clean or dusty, these *all-purpose transformers* will supply the power for your war loads with little or no maintenance.

*Pyranol is the G-E trade name for askarel, a noninflammable, nonsludging insulating liquid. Ask your G-E representative for Bulletin GES-2974—the complete story for a safer plant. General Electric, Schenectady, N. Y.

GENERAL ELECTRIC

1943

FIFTY YEARS

devoted exclusively to the design and manufacture of electrical equipment for circuit protection

★ SHAWMUT IS THE WORD FOR FUSES ★

The Chase-Shawmut Company
Newburyport, Massachusetts

1893

A vital message for every man who

PLAIN TALK ABOUT

Preventive maintenance will save your truck and money too!

How will your business run if your truck stops?

What are you doing to keep your truck running?

You can *prevent* breakdowns before they happen, *maintain* your truck in good running order for the duration, and *control* its cost of operation.

How? By using "preventive maintenance control" —a simplification of the system which operators of big fleets have used for years to make their trucks last longer, reduce road failures and cut operating costs.

"Doesn't that take a lot of time and elaborate bookkeeping?" you ask. Not today! Your service station or garage can make it easy for you.

How does "preventive maintenance" work?

In essence, it is plain common sense put on a systematic basis. It's a practical use of that "ounce of prevention" to save a "pound of cure." For example:

It's cheaper to adjust a fan belt than pay for a new radiator.

It's cheaper to change the oil regularly than put in new piston rings.

It's cheaper to tighten a few bolts than buy a new set of springs.

"Preventive maintenance control" consists of a regular schedule of check-ups, adjustments and servicing to prevent mechanical failures. There are dozens of points on every truck which need regular attention. So today many service men are using special check-lists which guard against overlooking a single point.

Every 1,000 miles the check-list calls for a grease job, the oil checked, the engine adjusted and inspection of tires, brakes and battery.

The 5,000 mile check-up also covers the oil filter, valve adjustment, rotation of tires, etc.

QUICK QUIZ FOR TRUCK OWNERS

CAN YOU ANSWER "NO" TO THE FIRST SIX QUESTIONS—AND "YES" TO SEVEN AND EIGHT?

1. Is your clutch slipping and thus wearing out quickly for lack of simple adjustment? YES ☐ NO ☐

2. Has your truck been more than 1,000 miles without correct lubrication at every point of mechanical friction? YES ☐ NO ☐

3. Have you got a brake shoe drum out of adjustment so that the drum overheats and may crack any day, requiring an expensive replacement? YES ☐ NO ☐

4. Are your tires wearing out too quickly because the wheels are out of line? YES ☐ NO ☐

Or because they have not been rotated? YES ☐ NO ☐

5. Have your axle bearings been more than 15,000 miles without the wheels being removed for inspection and repacking? YES ☐ NO ☐

6. Is your oil filter cartridge getting clogged up with dirt and threatening a complete engine failure? YES ☐ NO ☐

7. Have your spring clips been tightened recently to prevent breaking of spring leaves and expensive repairs? YES ☐ NO ☐

8. Do your brakes take hold smoothly and equally so that they are always ready in an emergency to prevent accidents? YES ☐ NO ☐

These are only a few of the many points which will be checked regularly when you give your truck "*preventive maintenance*" care.

UMI

needs a truck in his business

YOUR TRUCK ★ ★ ★

Every 15,000 miles or so there should be an exhaustive check-up with general tightening, wheel bearing overhaul, etc.

These check-lists insure that you get good "preventive maintenance"—*but only if you send your truck for regular and systematic check-up service.*

What will it cost you?

The out-of-pocket expense is low . . . and you *actually save money in the long run,* just as "big fleets" have been doing for years! What pays them in peacetime is doubly profitable for *you* today, when trucks and truck parts are difficult, if not impossible, to replace.

President Roosevelt and the Office of Defense Transportation urge every truck owner to use *preventive maintenance* in order to preserve the truck as a vital asset to the nation.

Taking care of your truck is a patriotic duty—good business for you and good business for your country. Every truck is vital to winning the war!

It's up to you. So when your service station or garage offers you a plan for "preventive maintenance control"—remember, they are prepared to help you *save your truck for your business and your country!*

HOW PREVENTIVE MAINTENANCE SAVES YOUR MONEY WHILE IT SAVES YOUR TRUCK

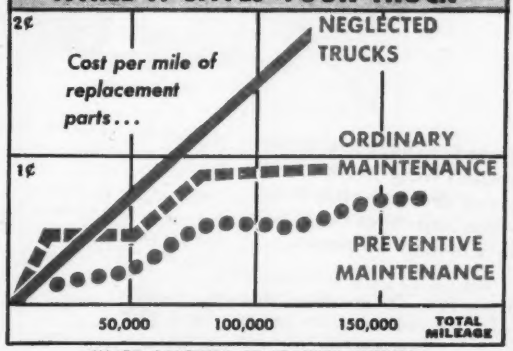


CHART COURTESY OF "BAKERS WEEKLY"

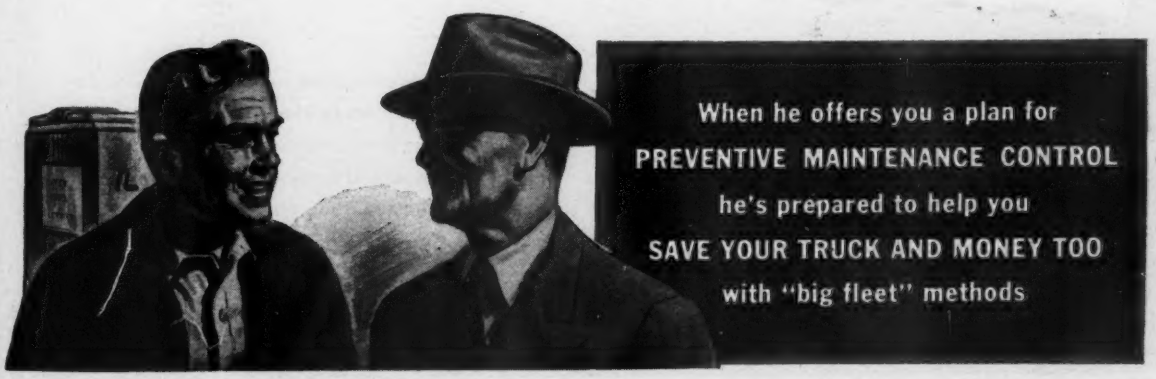
★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

This advertisement is published in the interest of national needs for truck conservation by the

ETHYL CORPORATION

Manufacturer of Ethyl fluid, used by oil companies to improve the antiknock quality of motor and aviation gasoline.

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★


When he offers you a plan for
PREVENTIVE MAINTENANCE CONTROL
he's prepared to help you
SAVE YOUR TRUCK AND MONEY TOO
with "big fleet" methods

Here..Here..
THAT FAN ISN'T SCRAP!

Full-Page Advertisements Will Appear in the SATURDAY EVENING POST Collier's American Home

Uncle Sam needs scrap, but doesn't want you to throw away irreplaceable things—like fans—that contribute to wartime efficiency.

Until the war is won, no more Emerson-Electric Fans are being made for civilian use, because their manufacture involves many critical war materials. All the fans now produced are for the Army, Navy, and other essential War Services.

So, if you own an electric fan—no matter what make—take good care of it. Then, when hot nights come, its cooling breezes will help you get refreshing sleep and keep you up to par. That is important.

If you own an *Emerson-Electric* Fan, you are fortunate. Its exceptional quality and long-life construction are greater assets now than ever before—they make your fan worth the care a superior product deserves.

Backed by the famous "5-Year Factory-to-User Guarantee"—many Emerson-Electric Fans are still going strong after 25 and more years of service!

THE EMERSON ELECTR MANUFACTURING C SAINT LOUIS

Branches: New York • Detroit • Los Angeles • Davenport

EVERYTHING EMERSON-ELECTRI

Power-Operated Airplane Gun Turrets

Parts for Artillery Ammunition

Electric Mot... for Air...

Check YOUR FANS NOW!

To get the best possible service from your Emerson-Electric Fans, follow these suggestions:

1 Don't wait. Check your fans now and you will be sure they are ready when you need them.

2 If they operate satisfactorily, clean them thoroughly [illegible] and oil with [illegible] mineral oil, grade SAE 10 or 20.

3 If there is any unusual noise or vibration, due to worn parts, or faulty electrical connections, take the fan to your Emerson Dealer or Electrical Repair Shop to determine whether it can be repaired. (Generally, if your Emerson-Electric Fan is not more than 20 years old, parts are available.)

295

EMERSON ELECTRIC ELECTRI...

MOTORS • FANS • APPLIANCES • A. C. ARC WEL...

Your Fan Customers—of former years—will thank you this summer because you sold them Emerson-Electric Fans. Your judgment in the selection and sale of quality merchandise has built confidence in your business and will be reflected in future sales when consumer goods are again available.

With all consumer fan production discontinued, for the duration, you can keep your customers' good will, profitably, by establishing a fan repair service. The advertisement reproduced here is designed to assist Emerson-Electric Dealers and Service Stations to [illegible] of this business. If you desire [illegible] enlarged size, for posting on your [illegible] write factory.

THE EMERSON ELECTRIC MANUFACTURING COMPANY, ST. LOUIS

Branches: New York • Dallas • Chicago • Los Angeles • Davenport

UMI

THIS IS THE SITUATION ON TAPE TODAY

As long as friction tape and splicing compound are needed for the far-flung communication systems of our Armed Forces and by the manufacturers of war products, these needs are first demands and take precedence over all others.

Anyone who needs rubber or friction tape for these purposes can still obtain Security on priority through his regular source of supply.

As a natural consequence, some of our customers with whom we have been doing business cannot get as much tape as they want as fast as they would like. We appreciate their cooperation and understanding of the situation and look forward to the day when we again can serve them as completely as before.

UNITED STATES RUBBER COMPANY

1230 SIXTH AVENUE • ROCKEFELLER CENTER • NEW YORK

For Continuing Achievement

A STAR FOR WESTON

—evidence that the vital instrument situation rests in good hands!

A star now adorns the ARMY-NAVY "E" pennant awarded to WESTON just 6 months ago . . . the first such pennant awarded in this highly specialized instrument field.

It's a star that has *real meaning*. Because, from the very beginning of our defense period, the responsibility for producing the vast quantities of instruments vital to the success of our country's efforts, has rested largely on the instrument leader.

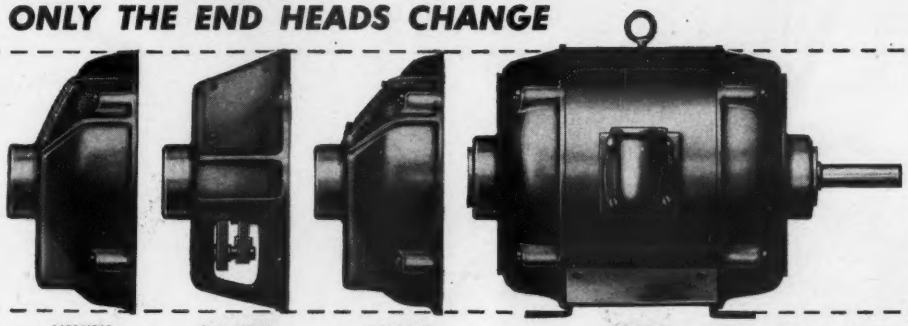
This star signifies that the responsibility *rests in good hands*. "The men and women of the WESTON Electrical Instrument Corporation," writes the Chairman of the Navy Board for Production Awards, "have achieved a signal honor by continuing their splendid production in such volume as to justify this award . . . indicating their solid determination and ability to support our fighting forces with equipment necessary for victory."

But a great instrument task still remains . . . before victory is ours. So WESTON workers continue reaching for new goals . . . with the same determination, the same painstaking devotion to the quality ideal, responsible for WESTON'S *continuing leadership* in the instrument field.

WESTON ELECTRICAL INSTRUMENT CORPORATION, NEWARK, NEW JERSEY

Here's why you get GREATER INTERCHANGEABILITY IN R&M Uni-Shell MOTORS!

ONLY THE END HEADS CHANGE



CAPACITOR SINGLE-PHASE INDUCTION MOTOR 1-5 H. P.

D. C. MOTOR AND GENERATOR ½-7½ H. P. ¾-5 K. W.

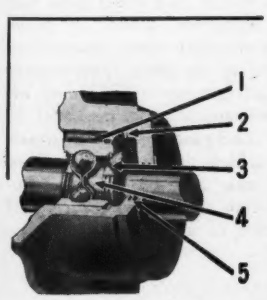
REPULSION INDUCTION MOTOR 1-5 H. P.

POLYPHASE INDUCTION MOTOR 1-30 H. P.

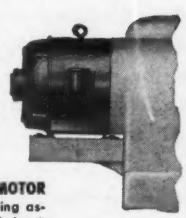
No other motors can give you the complete interchangeability you get in the new R & M Uni-Shell line! All motor types, in any one Uni-Shell frame size, have *identical* shell dimensions, shaft-head fit, bolt circle holes, base, shaft size, and conduit box mountings. Where one type of Uni-Shell Motor can be mounted, so can any! This is a *great* advantage for you, whether you use motors in your products, or just on your production machines.

30 MONTHS IN DEVELOPMENT

Robbins & Myers engineers devoted 30 months of concentrated effort to the development of R & M Uni-Shell Motors, and to testing them thoroughly in hundreds of tough war-production applications. Result: the *finest* line of motors we've produced in nearly 50 years of specialized motor building—greater *interchangeability* than has ever been known before—and many improvements in design and construction that contribute to longer motor life, greater dependability, and higher efficiency. Uni-Shell Motors are built in shells of steel for complete protection. Better bearings and better balancing assure unusually smooth, trouble-free operation. New insulating techniques, combined with the finest materials obtainable, increase motor life. And we have utilized our broad fan-building experience to make ventilation better than ever, keeping interior temperatures *below* guaranteed minimums.



FOR MAKERS OF MOTOR-DRIVEN PRODUCTS, this shows how the Uni-Shell fits against assembly. Whatever different *types* you use, no redesigning is necessary. All—in any one frame size—have *identical* shaft-head, shell, and mounting dimensions!



BETTER BEARINGS FOR LONGER MOTOR LIFE! 1. Double-row-width ball bearing assures an adequate supply of lubricant. 2. Spacing washer. 3. Complete seal, both sides—held in by snap rings that are easily removed for inspection, cleaning and re-greasing. The lubricant sealed in—dirt sealed out! 4. Exceptionally large grease reservoir. 5. Annular grooves filled with water-resistant grease to exclude water, dirt, fumes and other foreign matter.

20-PAGE BOOKLET TELLS THE WHOLE STORY

All of the many advantages and features of R & M Uni-Shell Motors are fully described and illustrated in a 20-page booklet just off the press. To get *yours* promptly, fill in the coupon below and mail it today.

Mail This Coupon Today!

ROBBINS & MYERS, INC., Springfield, Ohio

Gentlemen: Please send me your new 20-page booklet on Uni-Shell Motors.

Name.....*Position*.....

Company.....

Street Address.....

City.....*State*.....

I would ☐ would not ☐ like to talk to a representative. EC

ROBBINS & MYERS • INC.

MOTOR DIVISION, SPRINGFIELD, OHIO

HOISTS & CRANES • MACHINE DRIVES • FANS • MOYNO PUMPS • FOUNDED 1878

WE'RE LEARNING PLENTY

. . . *about Interior Communications*

"War production sure puts the pressure on a plant—shows up weaknesses — spotlights the tools and methods that are really efficient.

"Take interior telephones for instance. There's a whale of a difference between the system we use in Plant 2 and the P-A-X automatic telephones we use here.

"In the first place, our P-A-X is a separate system. We don't run into delays trying to put inside calls through a switchboard already busy with city and long distance calls. And our city telephone service is better because our operator is not burdened with inside traffic that the P-A-X system can handle better.

"The P-A-X is so easy to use that our employees prefer to get and give information by telephone. It has cut out most of the walking and 'visiting'. And another thing that is especially important now—there's no 5 o'clock handicap for the night shift or the departments that work overtime. The P-A-X keeps on working night and day.

"Yes, Plant No. 2 will get a P-A-X—even if we have to wait until after the war."

ELECTRICAL CONTRACTORS —IMPORTANT!

Today, new P-A-X equipment and other Automatic Electric intercommunication systems are reserved for the armed forces and other vital war agencies. However, scores of plant executives are now more aware than ever before of the time—and money—saving advantages of adequate interior communication. They will be quick to recognize the additional benefits which will be obtained from the new and improved Automatic Electric equipment which will be available to every business "tomorrow."

AUTOMATIC ELECTRIC

PRIVATE INTERIOR TELEPHONE SYSTEMS

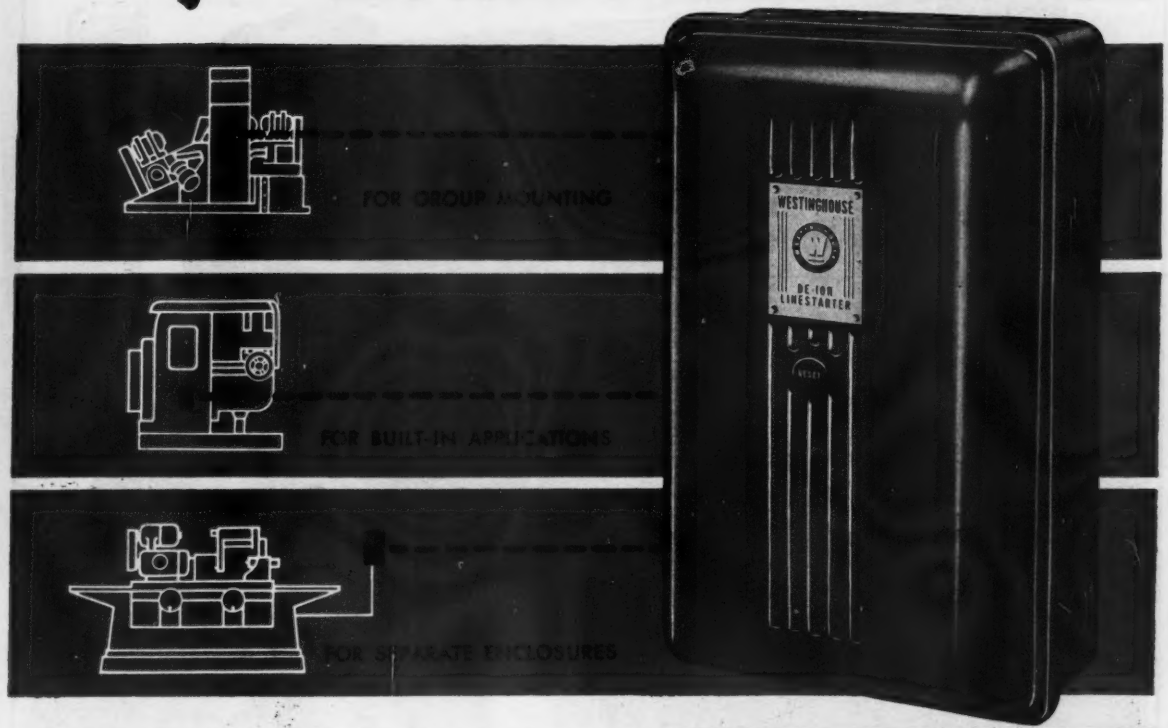
Distributed by: American Automatic Electric Sales Company, 1033 West Van Buren Street, Chicago, Ill.

Offices in Principal Cities. In Canada: Canadian Telephones & Supplies Limited, Toronto

NEW LINESTARTER

FITS PERFECTLY

INTO TODAY'S MACHINE TOOL PICTURE



Both in size and performance, this new Linestarter measures up to the requirements of modern machine tool design for compactness, easy mounting and dependable, trouble-free operation.

It is compact—ideal for group mountings and built-in applications. No crowding—all parts are quickly front-accessible.

It is flexible—coil is front-removable. Overload relay may be adjusted for either manual or automatic reset.

Sturdy and efficient, it is designed to give across-the-line starting, stopping, and overload protection under grueling 3-shift schedules. The armature is self-aligning—features a knife-edge bearing of nitrided steel that guarantees positive, accurate contact alignment. Service life of contacts is greatly increased by new, double-break construction.

Ask your Westinghouse representative for further details or write for Bulletin 3185. Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., Dept. 7-N. J-21254

NEW DESIGN FEATURES

SIZE 2 LINESTARTER

for A. C. polyphase motors up to 15 hp, 220 volts 25 hp, 440, 550 or 600 volts

- "De-ion" arc quenching—prolongs the contact life.
- Hand or automatic reset Bi-metal overload relay.
- Knife-edge bearing—an exclusive Westinghouse feature.
- Interlocks—space for as many as four.

Westinghouse MOTORS AND CONTROLS

Stop and Go Control

FOR AMERICAN INDUSTRY

Colt Dualbreak (illustrated) and Quadbreak Type "A" Safety Switches with multiple ruptures in each leg of the circuit reduce arcing, increase safety and assure long, satisfactory performance.

The traffic flow of manufactured goods, from raw materials to finished products, is maintained safely and uninterruptedly by Colt *Engineered* Safety Switches.

The *engineered* design, quality and ruggedness which is typical of Colt in all its products assures maintenance-free power control year after year.

Write for copy of COLTALOG which includes data on all Colt Safety Switches, Motor Controls and other electrical products.

COLT *Engineered* SWITCHES

COLT'S PATENT FIRE ARMS MFG. CO., ELECTRICAL DIVISION, HARTFORD, CONN.

Industries finest lighting

FLUORESCENT "40-A SERIES"

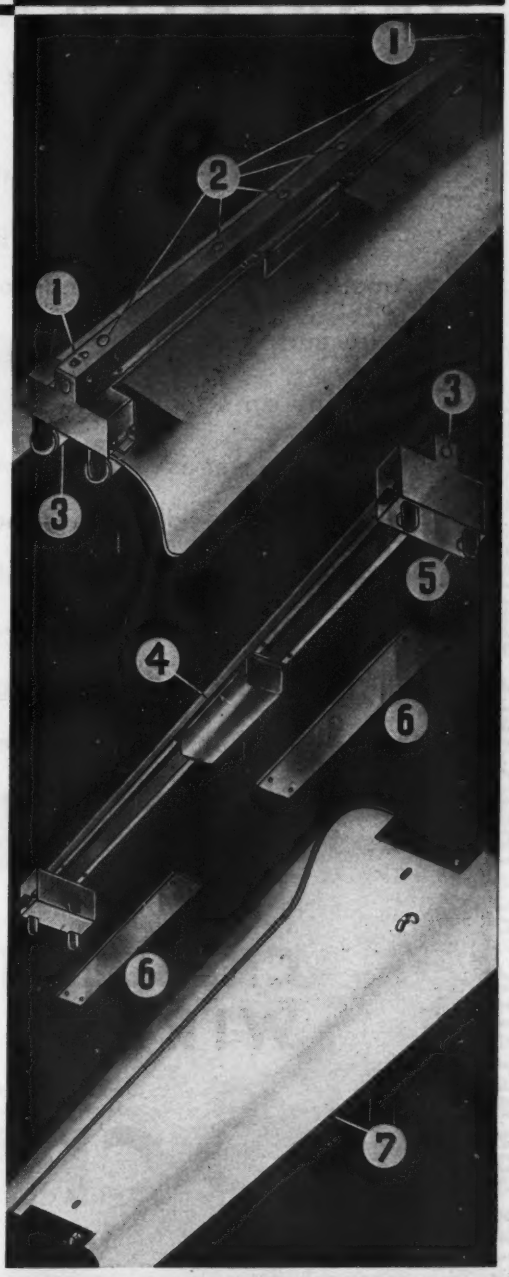
Look to L. P. I. for all these features

Every feature is included in this superb fixture not only to meet new government steel conservation orders but also to give you every advantage in installation and servicing.

1. **A depressed chain hanging device allows any type of mounting, at no increased cost.**
2. **Knockouts on the top surface allow making any connections which are normally utilized in hanging fixtures. Eliminates accessories.**
3. **Knockouts on the ends of the wireways give direct straight runs for continuous wiring.**
4. **The ballast mounted in the open below the wireway assures cool and efficient operation.**
5. **The socket covers, fastened at the sides, allow easy access to the boxes for wiring or servicing.**
6. **Two removable wireway channel covers give free and easy access to all parts of the fixture interior. Simplifies installing.**
7. **Masonite reflectors are formed in our own factory under "Controlled Conditioning". A "Klasium White" reflecting surface assures maximum light output.**

Continuous runs are easily accomplished by a simple coupling assembly.

Available in 2-40 watt, 3-40 watt, 4-40 watt, 2-100 watt and 4-100 watt.



Write for our bulletin No. 315, giving more details on this series. Sold through leading electrical distributors.

LIGHTING PRODUCTS, INC.
HIGHLAND PARK -- ILL.

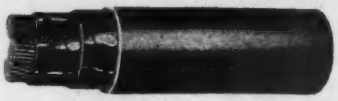
VARNISHED CAMBRIC · RUBBER POWER CABLES · BUILDING WIRE · RADIO WIRES · SIGNAL CABLE · FLEXIBLE CORDS · LEAD-ENCASED AND PARKWAY CABLES · ARMORED CABLES

CRESFLEX NON-METALLIC SHEATHED CABLE · SERVICE ENTRANCE CABLE · MAGNET WIRE · BARE WIRE

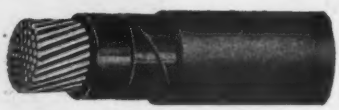
CRESCENT

INSULATED WIRE AND CABLE

Helps to Fill a Vital Need



This is a "Power Age." Power is the gigantic arm of production. 90% of American industry depends on power supplied through Electrical Wire and Cable.



At the CRESCENT plant production is 100% for war purposes

When the war is over, these same unexcelled production facilities, the same skills, the same research equipment, and the same time-tested management policies will remain coordinated to deliver to the Electrical Industry, through regular channels of distribution, the wire and cable that will be needed

in the future for peace time expansion that is to come.

CRESCENT INSULATED WIRE & CABLE CO.

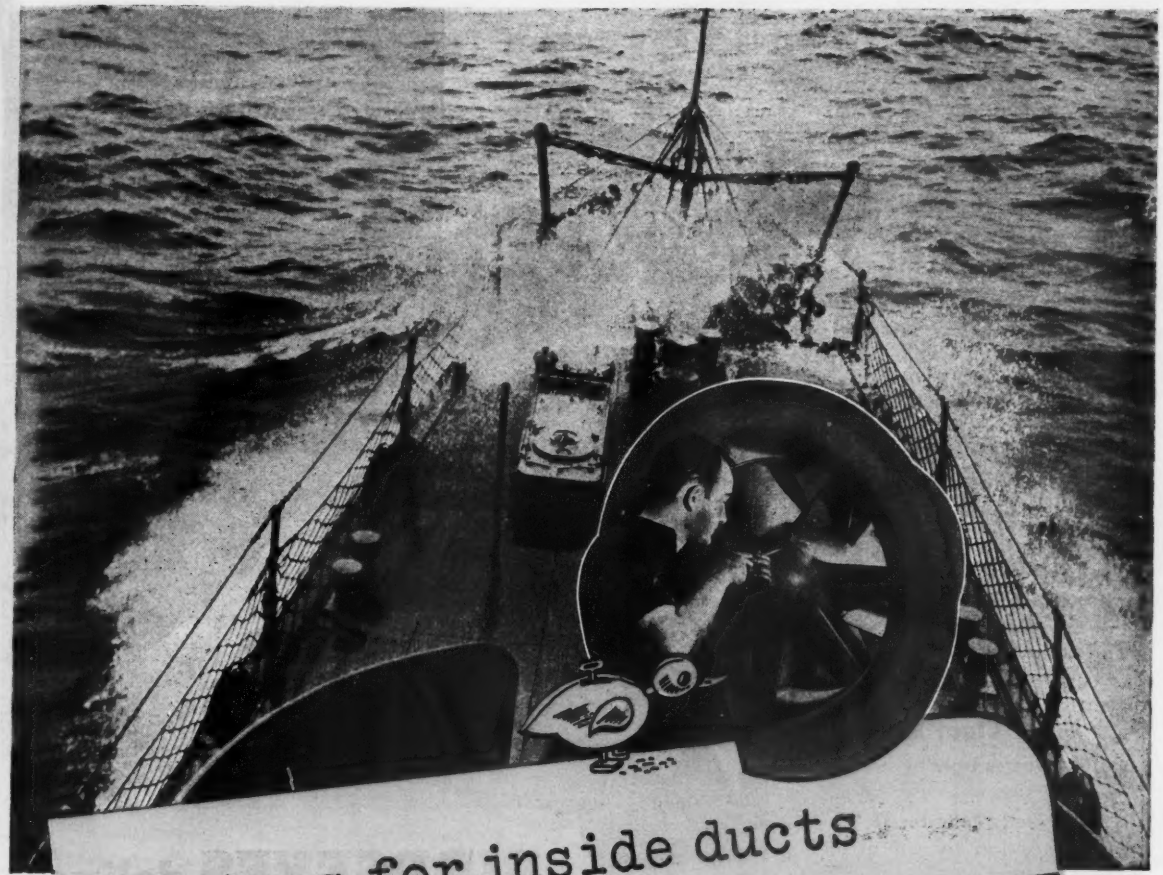
Ask Your Jobber For

CRESCENT
WIRE and CABLE
Factory: TRENTON, N. J.—*Stocks in Principal Cities*

CRESCENT ENDURITE SUPER-AGING INSULATION · WEATHER-PROOF WIRE

UMI

IO WIRES · SIGNAL CABLE · FLEXIBLE CORDS · LEAD-ENCASED AND PARKWAY CABLES · ARMORED CABLE
RE



Motors for inside ducts

IT'S WEATHER FOR EMERGENCY LIFE-LINES ON DECK THIS DESTROYER...BUT BELOW, CREW AND OFFICERS WORK IN COMFORT. SPECIALLY DESIGNED WESTINGHOUSE BLOWER MOTORS IN DECK DUCTS SUCK IN SEA AIR...CIRCULATE IT THROUGH A MAZE OF DUCTS FOR SHIP VENTILATION.

THESE COMPACT MOTORS AND FANS, BUILT AS AN INTEGRAL UNIT, FIT INSIDE DECK DUCTS. STURTEVANT DESIGNED THE VENTILATOR; WESTINGHOUSE — THE MOTOR. EACH UNIT MUST WITHSTAND THE GUN SHOCK AND POUNDING OF A SEA AND AIR BATTLE. IN ADDITION TO SAVING VALUABLE DECK SPACE, THIS SPECIAL MOTOR INCREASES VENTILATING EFFICIENCY MORE THAN 15% AND REDUCES NOISE LEVEL BY 25%.

SIMILARLY, MANY OTHER MOTOR AND CONTROL APPLICATIONS IN WAR INDUSTRIES REQUIRE SPECIALIZED ENGINEERING...CO-ORDINATION FOR FINISHED UNIT BETWEEN A WESTINGHOUSE PRODUCT AND YOURS.

USE OUR FACILITIES. ABOVE ALL, TAKE ADVANTAGE OF OUR MOTOR AND CONTROL APPLICATION EXPERIENCE. PHONE YOUR NEAREST WESTINGHOUSE OFFICE FOR IMMEDIATE HELP. OR WRITE WESTINGHOUSE ELECTRIC & MANUFACTURING CO. — DEPT. 7-N — E. PITTSBURGH, PA.

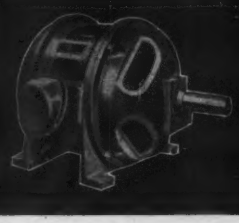
J-21178

WESTINGHOUSE

Westinghouse

PLANTS IN 25 CITIES · OFFICES EVERYWHERE

MOTORS AND CONTROL



1943
UMI

Compare

THE "OLD" AND "NEW" IN PLANT LIGHTING...

300-Watt BIRDSEYE Reflector Lamp

Controls Light scientifically with its own built-in reflector.

Needs no Fixtures. Every Birdseye a complete luminaire lighting unit in itself.

Saves on Maintenance. Pure silver sealed-in reflector stays brilliant and never needs cleaning.

300-Watt OLDSTYLE Clear Bulb

Wastes Light by scattering rays when used bare.

Needs Reflectors or luminaires to control and focus light.

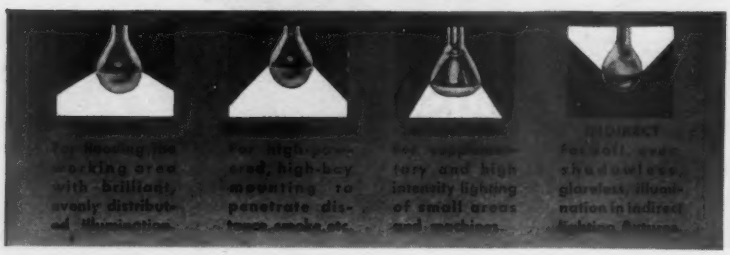
Costly to Maintain because reflectors need frequent cleaning.

BIRDSEYES deliver More Light to the SEEING AREA

CLARENCE BIRDSEYE was the first man to *do something* about the disadvantages of ordinary bulbs in industrial use. Birdseye saw light being wasted by dirty or inefficient bulb-and-reflector combinations. He noted the maintenance and cleaning necessary. And he knew that the *real answer* to better industrial lighting was a lamp *with its own perfect reflector* sealed inside the bulb itself.

Thus was inspired a *new* kind of lighting for industry — the Birdseye Reflector Lamp. Requiring no fixtures or maintenance . . . providing scientific illumination at the cost of bulbs alone, it has proved truly revolutionary in efficiency and economy.

The "Who's Who" of American industry have now adopted Birdseye Reflector Lamps after exhaustive tests in use. Leaders like Allis-Chalmers, Bliss & Laughlin, Curtiss-Wright, Delco-Remy, General Motors, Johns-Manville, Republic Steel, A. O. Smith, Vultee Aircraft, Willys-Overland — to name just a few—use Birdseyes to project more "light for seeing", full-force and without waste, to the work area. For complete information write today for Booklet M-5.

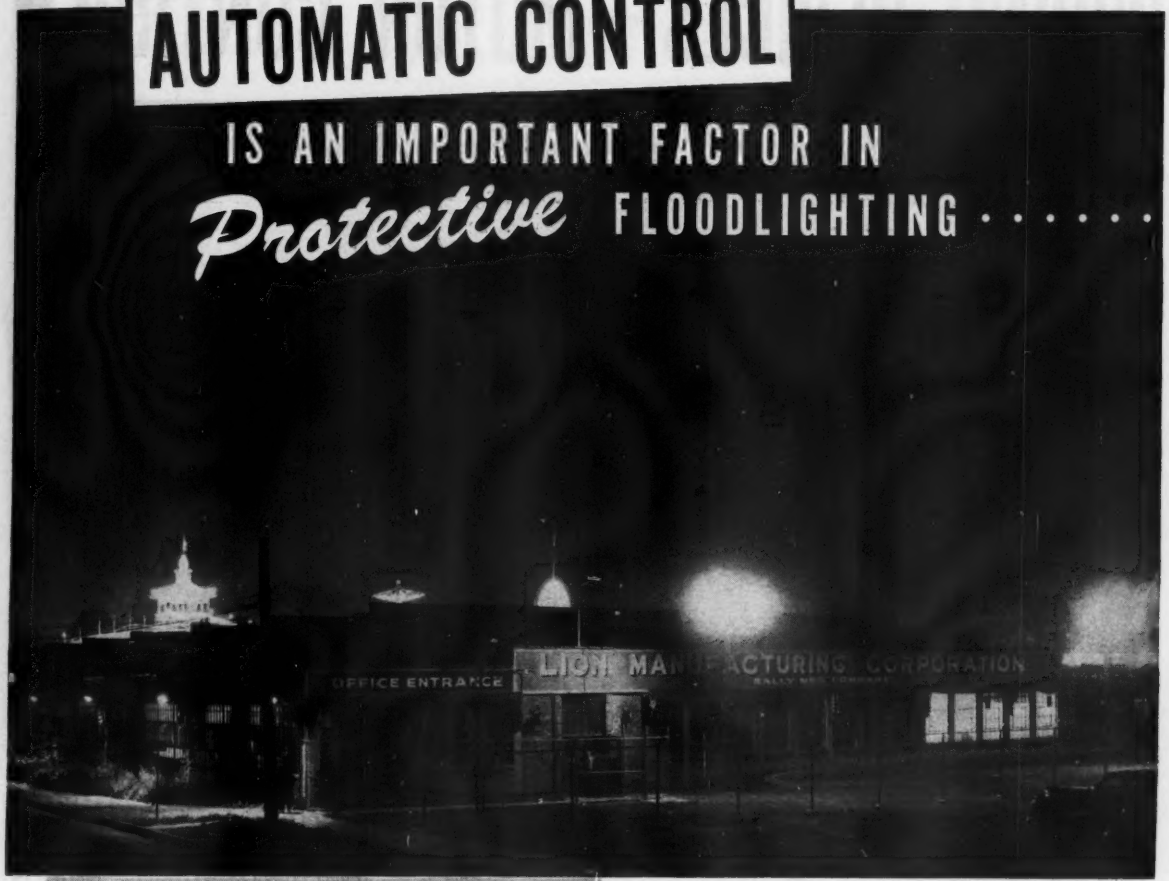


BIRDSEYE
REFLECTOR LAMPS

WABASH APPLIANCE CORP.
345 Carroll Street, Brooklyn, N. Y.

AUTOMATIC CONTROL

IS AN IMPORTANT FACTOR IN *Protective* FLOODLIGHTING . . . . . .



THERE'S THE EXACT TYPE OF SANGAMO TIME SWITCH FOR ANY SPECIFIC REQUIREMENT

In the Sangamo line are Astronomic Dial Synchronous Carry-over, and Outdoor Time Switches.

DURING BLACKOUTS

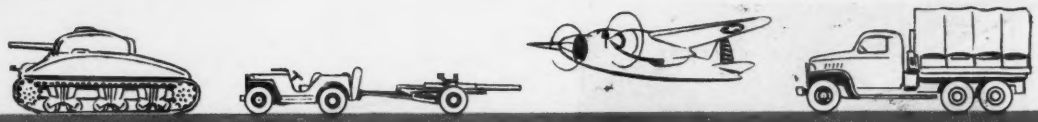
During any current interruptions, as for instance when a master switch is pulled for a temporary blackout, Form VSWZ Astronomic Dial Time Switch will continue to run for ten hours. An automatic carry-over feature provides for clock-spring operation when the current is off. The clock-spring rewinds automatically when the current is restored, and the time switch resumes its normal synchronous operation.

★ Full automatic control of protective lighting provided by Sangamo Time Switches is a guarantee that the on and off time of lights will be exact to the minute. Vital property serving in war production can't afford to take chances on lights dimming at the wrong time. Sangamo Time Switches are logical for these types of installations. A catalog showing all the Sangamo types of Time Switches and telling of the many purposes for which each is suited is available.

SANGAMO ELECTRIC COMPANY SPRINGFIELD ILLINOIS

WIRING DEVICES—MOTOR CONTROLS

PEACE-TIME PRODUCTS FOR WAR-TIME NEEDS ★
INVEST IN WAR BONDS
NINE Catalogs, specification and reference-bulletins; — which do you want to open to the items you need? For industrial wiring devices and motor controls, you need look no further than these complete listings. The lines are adequate to your war-job essentials; mostly available at once under proper priorities... These publications carry our contribution of "peace-time products for war-time needs", — always dependable; their dependability now more vital.
DISTRIBUTED THROUGH ELECTRICAL WHOLESALERS
ARROW-HART & HEGEMAN ELECTRIC COMPANY
HARTFORD, CONN. U. S. A.
ARROW
WIRING DEVICES
H&H
WIRING DEVICES
MOTOR CONTROLS
INDUSTRIAL ELECTRICAL EQUIPMENT
for Heating and Ventilating Systems
Marine
RADIO RECEPTION
ELECTRICAL EQUIPMENT



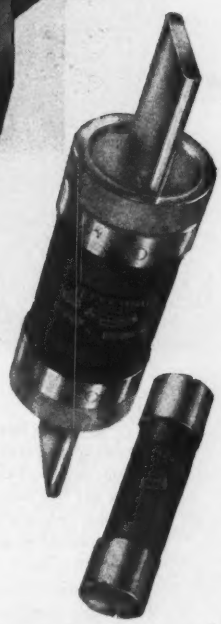
GUARD AGAINST PRODUCTION LOSSES

ONE BURNED-OUT MOTOR CAN CUT VITAL PRODUCTION SERIOUSLY

WHEN the steady production every minute of every day is so necessary to supply the Armed Forces with the combat equipment, munitions and supplies needed Now, —the crippling of just one motor is serious. One machine made idle because of a burned-out motor can hold up many steps of vital production.

The most reliable means of protection and preservation of motors and electrical circuits not only prevents production time losses but saves the copper needed for motor re-winding or motor replacement.

From the earliest days of the electrical industry Union Renewable Fuses have been the choice of experienced electrical men because of their uniform accuracy and reliability. They give the protection needed today to preserve electrical equipment—insure against production delays,—and blow only when serious damage impends. Specify Jefferson-Union Renewable Fuses for your power and lighting circuits—they are carried for your convenience by electrical wholesalers everywhere . . . JEFFERSON ELECTRIC COMPANY, Bellwood, (Suburb of Chicago) Illinois. *Canadian Factory:* 60-64 Osler Ave., W. Toronto, Ontario.



JEFFERSON UNION *Renewable* FUSES

- Super-Lag Renewable FUSES
- UNION and GEM Non-Renewable FUSES
- JEFFERSON PLUG FUSES
- JEFFERSON FUSTATS

JEFFERSON ELECTRIC

WIREMOLD

HELPED EQUIP HIM...

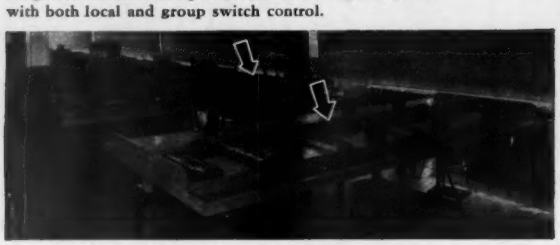
...IS HELPING

AMERICAN AVIATION INDUSTRIES

DELIVER MORE...BETTER...FASTER

PHOTO BY U. S. ARMY SIGNAL CORPS

Plugmold installed along work benches in optical plant with both local and group switch control.



THERE has been a Wiremold "helping hand" in the manufacture of many parts of his equipment... from the clothing he wears to the plane that carries him on his mission. In the textile mills, Wiremold helped provide better lighting and simplified the installation of new equipment. In the optical plant that supplied his goggles, PLUGMOLD . . . the Wiremold "Plug-in-Anywhere" convenience wiring system... helped speed production to meet his needs. In the plants that produced his arms, his ammunition and the giant troop transport he rides, Wiremold is making it possible to use electricity more efficiently ... for better lighting, for instant availability of portable tools and test equipment, for step-saving, time-saving convenience in a hundred and one different applications.

Adequate supplies of Wiremold are immediately available from stock for essential industrial installations and for use in equipment for war service. Wiremold conforms to Federal Specification W-R-32. Listed by U. L. The Wiremold Company, Dept. EC-5, Hartford, Conn.

Plugmold No. 2100 showing industrial type 3-wire outlets. Plugmold No. 1900

WIREMOLD

CAN HELP YOU

PRODUCE FOR WAR AND PLAN FOR PEACE!

"HELPING HAND" LITERATURE FOR CONTRACTORS

- ☐ Bulletin, "Wiremold Industrial System-Wiring Speeds War Production".
- ☐ Engineering Data Sheets, Plugmold Multi-Outlet Wiring Systems.
- ☐ Wiremold Catalog and Wiring Guide.
- ☐ Engineering Data Sheets No. "3000"-System Wiring for Industrial plants.
- ☐ "Pancake" Wiremold Overfloor Wiring System for Office and factory.

CHECK and return with your name and address

MORE EFFICIENT LIGHTING WITH LESS EQUIPMENT—*that's "Balanced" Lighting*

For Study and Counsel on Your Lighting Problems

Fostoria Industrial Service Centers located strategically in principal cities throughout the United States and Canada, are properly equipped and well qualified to solve your lighting problems. This service determines first, what each worker's seeing requirements are on the job so he may work faster, accurately, safely, with a minimum loss of efficiency. It carries on to analyze specifically the kind, quantity and distribution of lighting which will properly provide the worker's seeing needs. It then selects and positions the lighting equipment to meet these specifications and stands ready at all times to help maintain this equipment at top efficiency.

Saves Critical Material — *Saves* Power — *Saves* Worker's Eyes — *Saves* Time — *Saves* Investment

BALANCED LIGHTING

GENERALITE fostoria for Overall Lighting

LOCALITE fostoria for Light ON the Job

for Better Seeing in Industry

NEMA

Light for seeing is the worker's most vital tool—so, an efficient lighting system is based on his "seeing" needs.

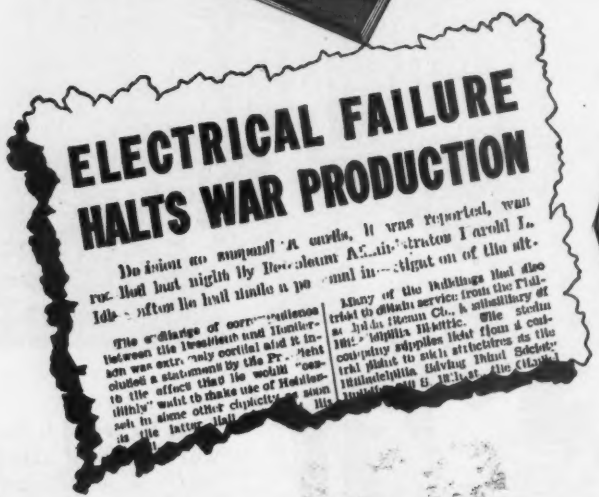
Workers on jobs involving precision machining, fine assembly, minute inspection and similar operations require high levels of illumination directly on the critical work area. This is "localized" lighting. Along with this primary lighting for seeing it is necessary to provide illumination for the overall work area and its surroundings. That is "general" lighting.

When these two distinct types of lighting are employed in the proper proportions the result is "balanced lighting," which is at once efficient and economical. It is efficient because the worker is provided with the right kinds and the right amount of lighting he needs to do his work well—in safety and comfort. It is economical because a minimum of equipment is needed to provide this lighting. Employing a minimum of equipment means substantial savings in both initial and operating costs —and, what is highly important at the moment, it means conservation of materials.

THE FOSTORIA PRESSED STEEL CORPORATION • Fostoria, Ohio
In Canada — Write Amalgamated Electric Corp., Ltd., Toronto

"Tomorrow may be too late—do it today!"...CHECK UP!

THIS



ELECTRICAL FAILURE HALTS WAR PRODUCTION

MIGHT HAVE PREVENTED

THIS

WARTIME restrictions make copper products hard to get — this includes electrical wire and cable. It will pay you to protect what you have.

Anaconda's Preventive Maintenance Plan will help you check to see that cables in your plant are not being abused.

If you follow this free plan you not only help yourself, but more important, you help the war effort. This manual provides a practical automatic method for complete analysis of circuits and equipment...uncovers potential weaknesses ...methods for correcting them...with charts to enable quick periodic check-ups.

NOTE: Through this Preventive Maintenance Plan you may uncover the evidence necessary to obtain an "emergency repair priority." This is explained fully in the plan book.

43127

ANACONDA'S PREVENTIVE MAINTENANCE PLAN

ANACONDA

Anaconda Wire & Cable Company
25 Broadway, New York City

Please send copy of the Anaconda Preventive Maintenance Plan for safeguarding production.

Individual .....

Company .....

Address ..... City .....

17

UMI

TRANSPORTATION—a vital war factor

The effectiveness of our armed forces and civilians alike depends on the efficiency of our transportation

As the battle of Tunisia entered its final phases, with the British and American forces joining hands to crowd Rommel into his last fox hole, Hitler and Mussolini held their twelfth war-time meeting.

One important purpose of this meeting, according to the Berlin radio, was the study of a specially prepared "Survey of Continental Reserves". Topping this list of resources is the item of transportation.

Hitler has a great many headaches these days but, according to no less an authority than the Reich Ministry of Economics, "the central problem of the whole German war effort is transportation". It is, in fact, the Achilles' heel of Germany's War Machine.

The Nazis have become soberly conscious of its crucial importance and Mr. Hitler must wince when he recalls the gigantic miscalculations which led him to neglect his railways.

He counted on a short war, not a long wear-and-tear war and Germany's transportation crisis is getting more critical by the hour. It will play a vital part in its defeat.

This is a war of movement—on land, on sea and in the air. Russia's 2,000 mile battleline, R.A.F.'s 700 mile bombing raids, General Montgomery's 1,500 mile advance last November and the vast area that constitutes the theatre of war in the Pacific make this fairly obvious.

Peace will come when one side gets control over the world's supply of fuel, oil and rubber, for on these three critical materials depend all the vehicles of war—as well as of peace.

An army used to travel on its stomach. Today it travels on its fuel tank.

On the home front, transportation is no less vital. Here it is essential in getting the war workers, their raw materials and their products, to and from the mines, mills and factories that supply our armed forces and those of our Allies. Transportation is a major factor in the nation's ability to out-produce its enemies. Every known method, every type of vehicle becomes essential, for no single group of carriers, freight or passenger, can meet all our needs.

The railroads opened the vast resources of our nation and continue to be the backbone of our transportation system. Today they are doing the greatest job in their history. They are hauling more tons of freight more miles than ever before—33% more than in 1941 and 55% more than in 1918, peak year of the first World War. They are carrying more passengers more miles than ever before—80% more than in 1941 and 24% more than in 1918. They are getting more work out of each car, each engine, and each mile of track than ever before. Private operation of railroads is proving far more effective and efficient in this war than did government operation in the last war.

In contrast to Hitler's Germany, the managers of the American railroads have not neglected their plant except where government priorities forced them to do so. They are turning in an unprecedented performance despite the long starvation period to which they were subjected. During the first World War the total investment in the American railroad plant was about $18,600,000,000. Since then $12,000,000,000 have been spent on improvements and after deductions for scrapped facilities the net increase has been $8,000,000,000. Since the present war in Europe began the railroads have invested about $1,650,000,000 in further improvements, many of them to meet special war needs.

Convincing evidence of the railroads' flexibility in meeting the special needs of all-out war is their performance in coping with the movement of oil to the East Coast. In January 1942, one month following Pearl Harbor, the railroads delivered to the East Coast by tank car less than 100,000 barrels daily. By December they had stepped this up to more than 740,000 barrels and during the week ended April 3, 1943 they

This is the eleventh of a series of editorials appearing monthly in all McGraw-Hill publications, reaching more than one and one-half million readers, and in daily newspapers in New York, Chicago and Washington, D. C. They are dedicated to the purpose of telling the part that each industry is playing in the war effort and of informing the public on the magnificent war-production accomplishments of America's industries.

averaged more than 900,000 barrels per day. By the end of this year they are shooting for the goal of one million barrels a day.

Unlike Germany we have not attempted to control the development and growth of motor transportation according to the "intuitions" of one man but have wisely left it in the hands of experienced competition. That is how our highway transportation system came into being. Growing public acceptance has made it an essential part of our national economy.

The motor vehicle, its limitations set only by the improved highway and the supply of fuel and rubber, has developed to undreamed of proportions. Up to a year ago private automobiles consistently moved more people more miles than *all public carriers combined*. Buses have become an accepted means of mass transportation. Local electric and interurban railways in many cases were converted to bus lines and trucks took over the local freight services. Under these improved operating conditions traffic volume increased. When the war in the Pacific made it necessary for us to conserve our supply of rubber and the U-boat depredations in the Atlantic throttled the flow of gasoline to the eastern seaboard, our motor transport was forced to grapple with the toughest problem that ever had confronted it since it became so vital a factor in the every day transportation.

The "share-the-ride" idea recognizes the need of conserving gas, oil and rubber. This particularly applies to buses, for wherever groups can be assembled for a common destination, buses can be used most effectively. The intercity bus performs for the rural areas the same service that the local bus renders for the residential areas of our cities.

Reorganization of railroad schedules, adaptation of motor transport, rearrangement of working hours, all have contributed to provide a flexible transportation service for men and materials to meet the critical needs of the war effort. Twenty thousand intercity buses are handling 635 million passengers a year which is 69 per cent more than in 1941. The fact that these buses carry a relatively larger percentage of the total coach passenger business than their seating capacity would indicate suggests that here, too, we are getting a more efficient use of these vehicles in terms of passenger loads carried. It is fortunate to note that the geographic location of most intercity bus lines does not coincide with that of the railroads but rather supplements it.

The contribution which the urban transport industry is making to the war effort becomes apparent when we consider that buses, trolley buses and street cars today carry passengers at a rate which promises to exceed the impressive total of 21 billions, as compared with 18 billions in 1942 and an average of 13½ billions for the period 1936 to 1941. And this the industry is accomplishing with a minimum of added equipment and despite a serious drain on its manpower.

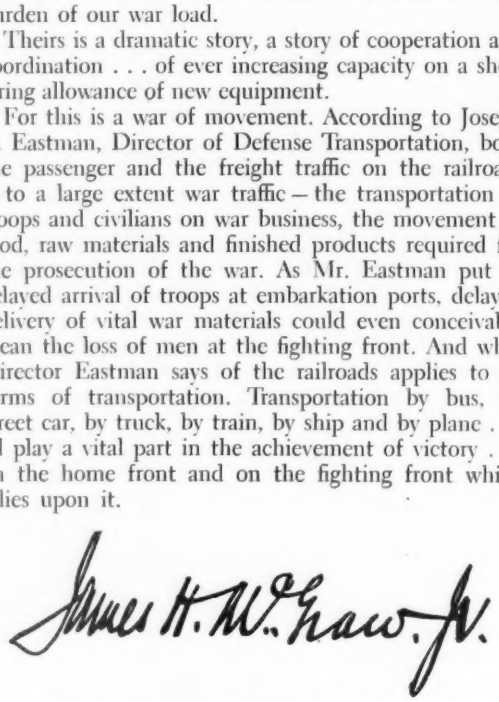
The truck lines, too, are setting all-time records. They have rearranged their schedules, eliminated circuitous routes and coordinated their services with those of other carriers. As this is written, contract truckers with the cooperation of the Office of Defense Transportation are trying to eliminate the empty return trip.

The transportation industry as a whole is face to face with the biggest job in its history. Increasing traffic loads, with little if any new equipment, difficulty in obtaining essential maintenance materials and a growing shortage of manpower, combine to make it that. While federal authorities, acting through the Office of Defense Transportation, took prompt cognizance of this condition, froze equipment and otherwise acted to conserve the vehicles then in service, it was not possible to add sufficient vehicles to keep pace with the increased traffic demand. However, the O.D.T. did lend impetus to the movement for staggering hours of work thereby spreading the peak loads and thus increasing the carrying power of existing fleets of vehicles in city service.

As we review the problems involved in meeting our transportation needs it is evident that we cannot depend upon new equipment alone for their solution. Lend-Lease is taking a considerable share of our much needed output of transportation equipment. The immediate job is up to the rank and file of the transportation industries. It is up to their resourcefulness and devotion to their job. The operating men out on the road, the men in the shops who keep the equipment going, who make the most of the metals and other materials they can have, who salvage, conserve and economize . . . these are the men who must bear the burden of our war load.

Theirs is a dramatic story, a story of cooperation and coordination . . . of ever increasing capacity on a shoestring allowance of new equipment.

For this is a war of movement. According to Joseph B. Eastman, Director of Defense Transportation, both the passenger and the freight traffic on the railroads is to a large extent war traffic – the transportation of troops and civilians on war business, the movement of food, raw materials and finished products required for the prosecution of the war. As Mr. Eastman put it, delayed arrival of troops at embarkation ports, delayed delivery of vital war materials could even conceivably mean the loss of men at the fighting front. And what Director Eastman says of the railroads applies to all forms of transportation. Transportation by bus, by street car, by truck, by train, by ship and by plane . . . all play a vital part in the achievement of victory . . . on the home front and on the fighting front which relies upon it.



President, McGraw-Hill Publishing Company, Inc.

Electrical Contracting

MANAGEMENT SERVICE

Agreements commonly referred to as "labor only" contracts are getting some intensive study these days. Excellent analyses like those prepared by the business research department of the Chicago Electrical Contractors Association are causing many contractors to review their accounting practices. And even a brief study must inevitably bring out the main fallacy of "labor only"—that there is no such thing as a "labor only" job in the electrical contracting business.

For cost accounting purposes it is common to separate the elements of the job into five parts; materials, labor, direct job expense, overhead and profit. This practice happens to be convenient for the estimator and the bookkeeper. It provides the necessary figures for checking job progress. Most important, such a breakdown provides the necessary yardsticks of technical and management efficiency. Such separation of cost brings out the monetary successes and failures at brief intervals of each responsible member of the operating staff. It shows where corrective measures are required to balance progress or speed up the job or make more money or thin out crews or solve the multitude of details that must be met every day on every job.

And, through the years, we talked of material, labor, overhead and the others as though they were independent categories, readily separable from the whole. Our customers, likewise, followed this arbitrary accounting practice in dealing with us. Partial payments during the course of the job usually required a report on materials, labor and job expense. The breakdown provided a ready index. The labor figure, for instance, made a good measure of the percentage of completion, independent of materials stored on the job. But even though they can be easily separated for examination these cost figures represent parts of the job which are, in fact, very closely related to each other and to the vitally important management service which never appears on the books as a distinct item.

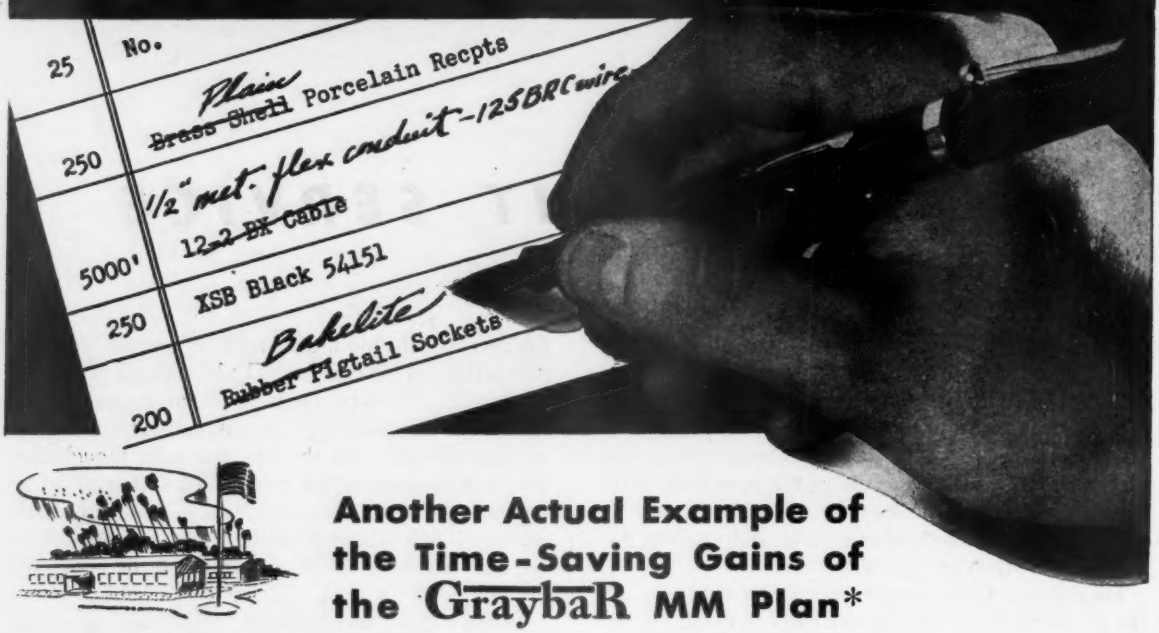
When a buyer says he wants "labor only" he means that he will provide an unspecified quantity and quality of materials to the job at unknown intervals and unknown degrees of fabrication. In other words, "labor only" is a contract for electrical work with the material column partially eliminated and the management costs enormously increased.

If the increased management costs and increased risks are figured in their true perspective, there will be fewer losses to contractors in "labor only" contracts. But, more important, there will be fewer "labor only" contracts. Such contracts are inherently inefficient and wasteful. They ignore the prime business function of the contracting organization—management service.

Wm. F. Stuart

MAY, 1943

BY FILLING-IN *"Between the Lines"* THE ORDER WENT OUT COMPLETE



Another Actual Example of the Time-Saving Gains of the GraybaR MM Plan*

A CONTRACTOR faced with the job of pushing 150 miles of Central American highway through the jungle had to begin with barracks construction and other basic facilities calling for a wide range of electrical supplies. The sailing date for supply ship from a West Coast port had been set for 8 days hence.

THE BILL OF MATERIALS that was rushed to GRAYBAR showed many items that could only be obtained from the East, and then on 8 to 10 weeks delivery. But GRAYBAR looked at the list realistically. In almost every case, "pinch-hitters" which could be substituted for the missing items were available from GRAYBAR's local warehouses or local sources of supply.

GRAYBAR SPECIALISTS sat down with the contractor's engineers and checked through the list item by item. Porcelain outlet boxes replaced steel, Bakelite pigtail sockets replaced rubber, and so on down the line. Years of experience on wiring supplies, plus up-to-the-minute delivery facts, enabled GRAYBAR to build a *complete* list for the job that could be shipped on time.

BY FILLING-IN between the lines, the entire shipment was on board at sailing time. The barracks were satisfactorily wired and equipped.

*Serving as your MATERIALS MOBILIZER

By this GRAYBAR service, your electrical needs are linked to the available output of 200 manufacturers, mobilized locally at more than 80 warehouses. The MM Plan "dovetails" GRAYBAR'S procurement work with your own purchasing requirements. You save time in getting estimates, checking specifications, expediting delivery, locating "hard-to-get" items. Ask your local GRAYBAR Representative how this "one-call" service can help you.

Executive Offices: GRAYBAR BUILDING New York, N. Y.

GraybaR

IN OVER 80 PRINCIPAL CITIES

UMI

Non-Critical Supports

Critical material conservation was the prime consideration in the electrical system design of the newest airplane plant. High tension distribution, wood structures, open wiring and non-metallic lighting units saved tons of copper and steel.

By C. W. Burney
Chief Electrical Engineer
The Austin Company
Cleveland, Ohio

ONE of newest plants built for aircraft production is reputed to be the largest timber-framework structure in the world. When the U. S. Army Engineering Dept., under whose supervision the plant was built, gave the "save steel" order, the Austin Company, designers, engineers and builders approached it as a challenge to their ingenuity. As a result they built a plant in which one has to look long before seeing any noticeable amount of critical materials.

Unconventional as it may seem, this conservation theme was carried throughout the entire electrical system, from main substation to outlets. The problem was not one of merely substitution of materials, but incorporated careful design and choice of equipment.

Electrical work on the huge project was divided among seven contractors—Harmon Electric Co.; Ernest Freeman and Co.; Hoffman Electric Co.; Garden City Engineering Co.; Monroe Electric Co.; and Crescent Engineering Co., and F. T. Morrissey.

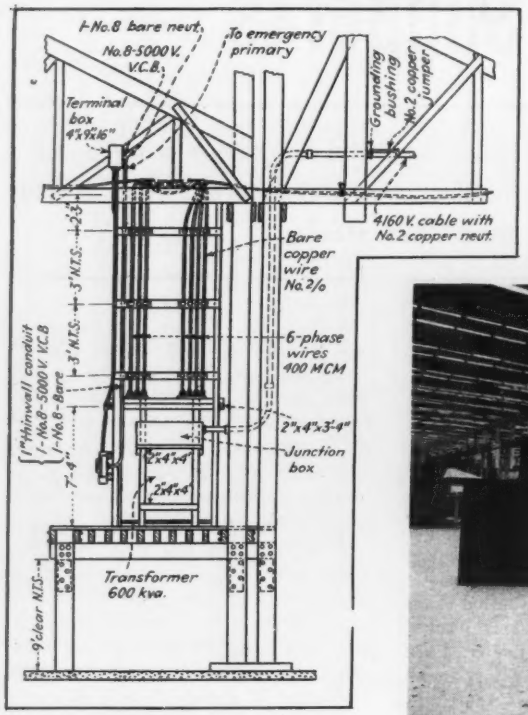
Conservation began at the high tension main substation, where the superstructure was built of 50-ft. wood poles and wood cross pieces, eliminating steel entirely. Primary buses consisted of one 2-inch iron pipe per phase in place of the conventional copper tubing. Three 5000 kva., 66,000/4160-volt, 3-phase, oil cooled transformers were purchased with 11 percent instead of the normal eight percent impedance and installed in preference to three single-phase units. This design feature permitted the use of 50,000 kva. interrupting capacity switchgear instead of 150,000 kva. necessary under normal design. Savings affected on this equipment alone were in the order of 25 percent on steel and 50 percent on copper.

Each transformer feeds a primary bus through a main circuit breaker. These buses are interconnected by normally open tie breakers electrically interlocked with the main breakers so that, in the event of an emergency, any one feeder may be served by any one of the transformers, but no two transformers can be paralleled.

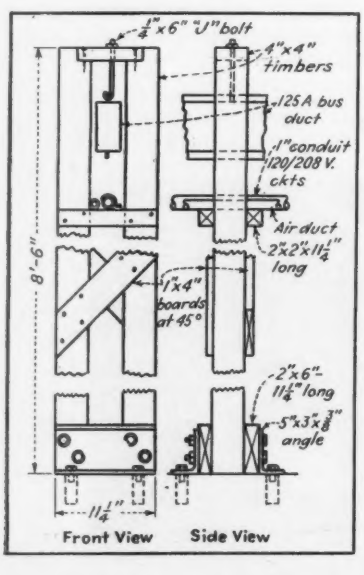
From the 4160-volt cubicles in the boiler house, feeders consisting of 3-conductor, oil base insulated, braided aerial cables with a spiral bare neutral conductor run overhead to numerous mezzanine substations in the assembly building. In general, each 4160-volt cable feeds two substations through G. & W. oil filled cutouts used as primary fuses and disconnect switches for the 3-phase, 4160 V —Δ/440/254 V—Y air cooled transformers. These units vary in size from 100 to 1000 kva., depending on the load connected to the secondary.

Contrary to normal practice, the mezzanine substations are constructed entirely of wood and are generally located

ALL-FLUORESCENT LIGHTING *provides an average maintained 35 foot-candle intensity of general illumination in the assembly building. Each unit contains two 100-watt, 3500 degree white lamps with one ballast operating four lamps on a sequence starting circuit.*



TIMBER SUPPORTS *carry the bus duct distribution system between rows of machines. Duct is underfloor fed from overhead open wiring feeders.*



WOOD CROSS ARMS *support fluorescent lighting units at truss chord level. Arms with fixture brackets and cable supports are mounted first. Completely assembled and lamped units are then snapped into place and aligned.*

WOOD STRUCTURES *support mezzanine transformer substations. Open wiring secondary feeders are installed up in the trusses and out of the way. Primary feed to transformer is protected by conduit.*

UP IN THE RAFTERS *and out of the way are all the small air cooled transformers and necessary disconnect switches controlling sub-feeders and branch circuits.*

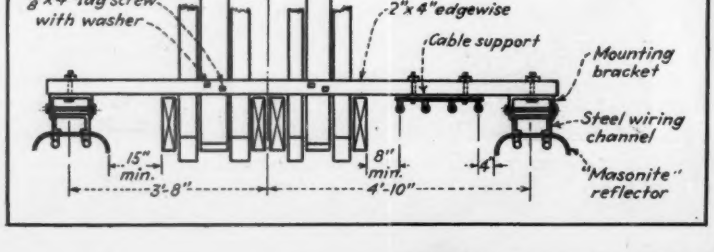
above a storage or toilet area. A concrete floor slab and curbing are unnecessary because of the use of air cooled transformers. Each transformer is surrounded by a wood structure built to support the primary cutouts, secondary air circuit breakers, secondary feeders, and emergency lighting transformer and panel. The primary cable is protected by rigid conduit from the roof trusses to the transformer and its bare neutral is bonded to the conduit at the entrance point.

All equipment in the substation is bonded to a No. 2/0 bare copper ground wire connected through a transite conduit to a 10-ft. ground rod driven directly below the substation platform.

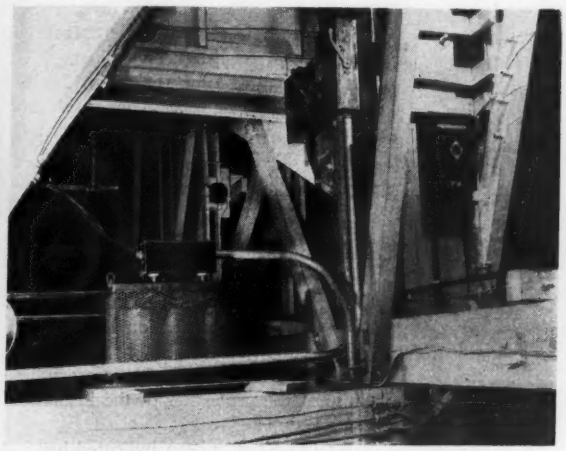
The average substation is approximately 14-ft. square. Those mounted above toilet areas are considerably larger, covering the entire area occupied by the rooms below. The platform is enclosed by a 6-ft. wood picket fence instead of the conventional wire type and access is by ladder only, assuring that only authorized persons will enter the substation.

Two sets of secondary feeders, protected by the air circuit breakers mentioned above, emanate from each mezzanine substation. These are three-phase, 4-wire, 440/254-volt open wiring circuits consisting of one 400 MCM. varnished cambric and braided conductor per phase leg and a No. 2/0 bare copper conductor for a neutral. These circuits run along the trusses to serve the lighting, power bus duct and underfloor duct circuits.

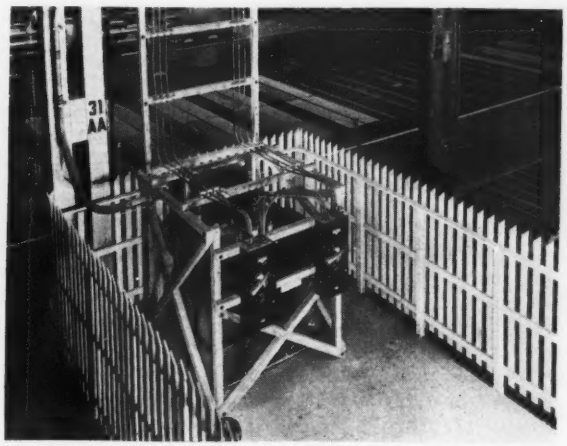
Although a secondary network system was desirable, economy and material scarcity overruled it. The next best thing was done. The secondary feeders of the mezzanine transformers are not interconnected, but come within 25-ft. of meeting each other. This span can be bridged in case of an emergency, giving added flexibility.



Power for the various machine tools in the machine shop and fabricating areas is distributed through comparatively short runs of 125 ampere bus duct feeding double rows of machines mounted back to back to the duct. Because of an extensive monorail system, the overhead areas had to be kept perfectly clear. Hence, the duct was mounted to special modified "A" supports of 4-in. by 4-in. timbers. Duct runs were underfloor fed by conduit enclosed subfeeders mounted to the nearest columns. These risers were tapped to the open wire feeders in the trusses through a fused disconnect switch. Individual machine connections were made through bus duct plugs and 4-wire rubber covered heavy duty cable supported by wood swivel arms and in some cases by porcelain insulators on the duct supports.



FLEXIBLE DISTRIBUTION *in the machine areas is provided by timber-supported bus duct. Wood swivel arms support 4-conductor cable connections to individual machines*



TYPICAL SUBSTATION *on wood mezzanine transforms primary power into a 440/254 volt, 3-phase, 4-wire system for secondary distribution. Two sets of secondary feeders leave each transformer.*

Parallel to the power duct and mounted to the same supports are 120/208 volt circuits for portable tools and individual machine lights where necessary. These circuits feed outlets at convenient points and are enclosed in thin-welded metallic tubing.

At various locations throughout the assembly area, a network of underfloor ducts carry 3-phase, 4-wire, 120/208 volt circuits for power, supplementary machine lighting and portable electric tools. Since the underfloor duct is of the oval fibre type, it is mounted on separate concrete foundations to prevent buckling and breaking when the floor is poured. The underfloor system is fed at various points through 25 kva. 3-phase, 440/120/208 volt air cooled transformers mounted to the upper side of the truss chords and connected to the open wire feeders through a fused disconnect switch. Individual circuits in the ducts are protected by breakers in multi-breaker panels mounted to the building columns. Column risers are enclosed in thin-walled metallic tubing.

An overall system power factor of 95 percent is maintained by three 400 h.p. and one 100 h.p. synchronous motors driving air compressors in the boiler house. When idling these units float on the line as synchronous condensers.

General lighting throughout the assembly, administration and personnel buildings and the cafeteria is provided by industrial type, open end fluorescent units equipped with non-metallic "masonite" reflectors in place of steel.

Cool, even illumination of 35 foot-candle maintained intensity is provided in the main assembly building by some 23,000 Electro No. B202 fluorescent fixtures, each accommodating two 100-watt, 3500 degree white lamps. Units are assembled in 11-ft. sections (two 200-watt fixtures) and wired with a single ballast operating the four lamps on the new General Electric sequence starting circuit. Savings of approximately 11,500 ballasts were effected.

A semi-continuous row pattern is employed with groups of six 11-ft. sections mounted end to end. Rows are on 25-ft. centers with approximately 9 feet between ends of the fixture groups. Mounting height in the assembly area is 35 feet; in the sub-assembly and shop areas, 28 feet. In general, double rows of units are installed flush with and parallel to the bottom of the roof truss chords—one on each side of the truss and supported at 8-ft. intervals by 2-in. by 4-in. cross arms equipped with fixture mounting brackets and bolted to the truss members. In some areas, single rows are mounted in a similar manner.

The groups of lighting units are fed directly from the 254-volt, 400 MCM. open wire buses that serve the power load also, thus eliminating the numerous lighting transformers required for 110 volt systems. Sub-feeders, connected to the main secondary feeders through fused disconnect switches, serve 10 rows of lighting units (120, two lamp fixtures). Connected to each sub-feeder are five, 30-ampere, three-pole, fused disconnect switches, each energizing two rows of fluorescent units. Four-conductor cables emanate from these disconnects and enter the fixture wiring channel used as a raceway for the circuit conductors feeding the entire row.

Another design point which saved considerable critical material was the elimination of lighting panels, and the sectionalized control of illumination. A magnetic contactor is installed in the sub-feeder to each group of 120 fixtures covering an area 125-ft. by 150-ft. A momentary contact pushbutton, conveniently located on a building column controls this contactor and all lighting connected to it.

Two methods were used to mount the lighting units in the comparatively high bay areas. The Harmon Electric Company, one of the contractors on the job, designed a special portable scaffold that clamped to the truss chords and worked from that. Rolling scaffolds were impractical because of the amount of equipment on the floor and the fact that some areas were completed before the floor was poured. On the other hand Ernest Freeman & Company, another contractor on the job, assembled six 11-ft.

[Continued on page 138]

EMERGENCY WIRES

Underwriters' Laboratory engineers outline the uses and limitations of the new wire insulations in interior wiring systems.

By L. C. Neumann

Asst. Electrical Engineer
Underwriters' Laboratories, Inc.

THE establishing of regulations and standards for the construction and proper installation of electrical equipment is the important combined function of the electrical manufacturers, the Electrical Committee which is in charge of the National Electrical Code, the inspection authorities, and Underwriters' Laboratories.

To save vital materials but at the same time to uphold safety, Interim Amendments have been issued by the Electrical Committee to permit or recognize for the duration of the emergency certain practices and products not normally allowed under the existing rules of the 1940 edition of the National Electrical Code.

One Interim Amendment of particular interest is No. 69. This amendment recognizes a substitute for rubber insulation of electrical wire under limiting conditions as outlined in the amendment which reads as follows:

"To assist in conserving rubber, and for the duration of the emergency, conductors with emergency insulation (Type EI) may be used as the ungrounded conductor for non-metallic sheathed cable run exposed, and for open wiring on insulators under the following conditions:

1. In dry locations only.
2. For voltages not exceeding 600 volts.
3. If there are more than four conductors larger than No. 10 in an outlet box or junction box, or in a cabinet cutout box, the conductors must be individually wrapped with non-combustible insulating tape. Type EI conductors shall not be used in damp or wet locations or any hazardous locations except as provided for open work in Section 5075. When in damp or wet locations, conductors with emergency insulation with lead covering (Type EIL) may be used in accordance with Section 3035."

Two types of EI wire now listed by Underwriters' Laboratories may be briefly described as follows:

One manufacturer's variety of Type EI wire is listed in sizes of No. 14 AWG and larger. It has a copper conductor over which is applied a tape of cellulose acetate butyrate compound, commonly known as Kodapak. Two strips of this tape are laid longitudinally on opposite sides of the conductor and wrapped around it to form two concentric layers. Over this are applied eight or more moisture-resistant, treated paper strips. These are applied as a helical wrap and are smoothed down. On size No. 6 AWG and larger two layers of paper are used. The outer layer of either the single or double wrap is partially saturated with an asphalt compound. The outer fibrous covering consists of a cotton wrap similar to that used on Type R wire, and is saturated with moisture-resistant and flame-retardant compounds.

In the manufacturing process the Kodapak strips fuse together to form a complete sheet around the conductor. The finished wire has an outside dimension closely approximating that of Type R wire of the same size.

Type EI wire is marked with one or more colored threads in the fibrous covering. Printed on the wire is the manufacturer's name and "Type EI." The label of Underwriters' Laboratories, applied to coils of this wire is marked: "Inspected Emergency Insulated Wire Type EI."

Type EIL is the EI wire with a lead sheath.

Another manufacturer's EI wire is also recognized in No. 14 AWG sizes and larger. It consists of paper strips over the copper; these strips are crumpled and are applied helically by a special interlocking process, folded and ironed down to produce an insulation of thickness equivalent to that specified for rubber-covered wire. This paper is impregnated with a heavy black saturating compound.

It may be of interest to know the conditions under which the insulation resistance of these wires is determined. The insulation resistance is measured after the wire has been immersed in water at 60° F. after periods of 24, 48, 168 and 336 hours. The insulation resistance varies from approximately 2100 megohms per 1000 feet after 24 hours of immersion to 12 megohms per 1000 feet after 336 hours. Continued immersion results in the lowering of insulation resistance. In the regular inspection of this wire at the factory, the insulation resistance is measured after a 12-hour immersion test.

The conditions governing the use of this wire are considered necessary because of the properties of the insulation employed.

As has already been indicated herein, Interim Amendment No. 69 specified that:

EI wire may be used as the *ungrounded* conductor for non-metallic sheathed cable *when this cable is run exposed,* and

EI wire may also be used for open wiring on insulators.

The reason for requiring this wire to be installed in the open is to permit easy removal after the war.

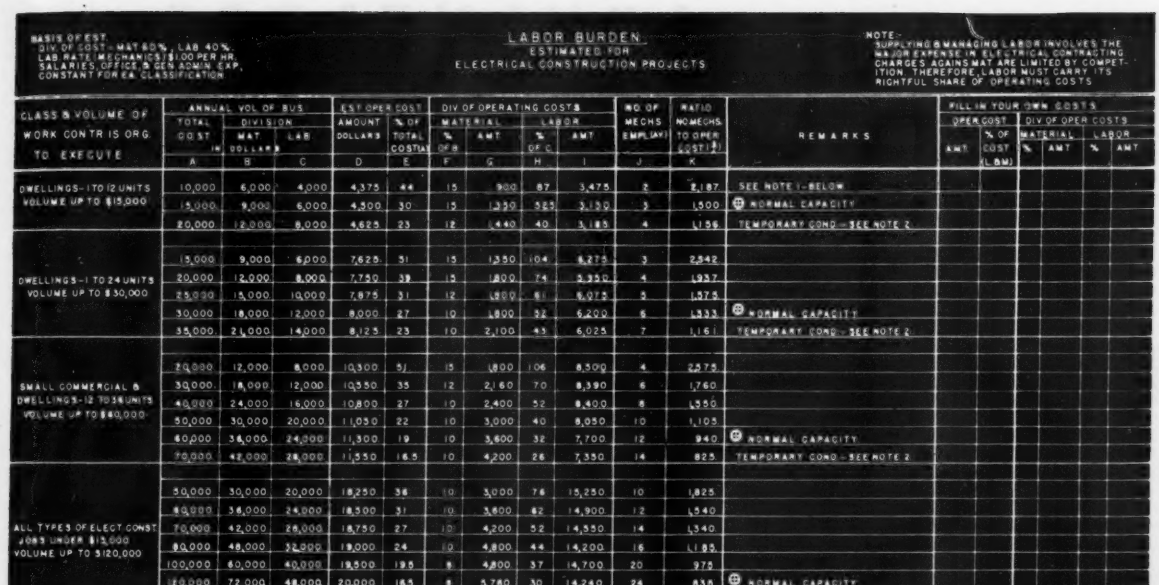
Type EIL wire may be used in accordance with Section 3035 as ungrounded conductors for wet locations as follows:

1. Underground.
2. In concrete slabs or other masonry in direct contact with the earth.
3. In wet locations.
4. Where condensation and accumulation of moisture within the raceway is likely to occur.

The Type EG wires are intended for use as substitutes for rubber-insulated wire under the conditions stated in Interim Amendment No. 44. This amendment reads as follows:

"To assist in conserving rubber and for the duration of the emergency, on alternating-current systems, slow-burning waterproof conductors (Type SBW), weatherproof conductors (WP), emergency insulated conductors (Type EI), or other types specifi-

[Continued on page 137]



BASIS OF EST.
DIV. OF COST - MAT 60%, LAB 40%.
LAB. RATE (MECHANICS) $1.00 PER HR.
SALARIES, OFFICE & GEN. ADMIN. EXP.
CONSTANT FOR EA. CLASSIFICATION

LABOR BURDEN
ESTIMATED FOR
ELECTRICAL CONSTRUCTION PROJECTS

NOTE -
SUPPLYING & MANAGING LABOR INVOLVES THE MAJOR EXPENSE IN ELECTRICAL CONTRACTING CHARGES AGAINS MAT ARE LIMITED BY COMPETITION. THEREFORE, LABOR MUST CARRY ITS RIGHTFUL SHARE OF OPERATING COSTS

CLASS & VOLUME OF WORK CONTR IS ORG. TO EXECUTE	ANNUAL VOL OF BUS			EST OPER COST		DIV OF OPERATING COSTS				NO OF MECHS EMPLOY'D	RATIO NO MECHS. TO OPER COST ($)	REMARKS	FILL IN YOUR OWN COSTS			
	TOTAL COST	DIVISION		AMOUNT	% OF	MATERIAL		LABOR					OPER COST		DIV OF OPER COSTS	
		MAT	LAB	DOLLARS	TOTAL COST	% OF B	AMT	% OF C	AMT				AMT	% OF COST (L&M)	MATERIAL %	MATERIAL AMT	LABOR %	LABOR AMT
	IN DOLLARS																	
	A	B	C	D	E	F	G	H	I	J	K							
DWELLINGS - 1 TO 12 UNITS VOLUME UP TO $15,000	10,000	6,000	4,000	4,375	44	15	900	87	3,475	2	2,187	SEE NOTE 1 - BELOW						
	15,000	9,000	6,000	4,500	30	15	1,350	525	3,150	3	1,500	② NORMAL CAPACITY						
	20,000	12,000	8,000	4,625	23	12	1,440	40	3,185	4	1,156	TEMPORARY COND - SEE NOTE 2						
DWELLINGS - 1 TO 24 UNITS VOLUME UP TO $30,000	15,000	9,000	6,000	7,625	51	15	1,350	104	6,275	3	2,542							
	20,000	12,000	8,000	7,750	39	15	1,800	74	5,950	4	1,937							
	25,000	15,000	10,000	7,875	31	12	1,800	61	6,075	5	1,575							
	30,000	18,000	12,000	8,000	27	10	1,800	52	6,200	6	1,333	② NORMAL CAPACITY						
	35,000	21,000	14,000	8,125	23	10	2,100	45	6,025	7	1,161	TEMPORARY COND - SEE NOTE 2						
SMALL COMMERCIAL & DWELLINGS - 12 TO 36 UNITS VOLUME UP TO $60,000	20,000	12,000	8,000	10,300	51	15	1,800	106	8,500	4	2575							
	30,000	18,000	12,000	10,550	35	12	2,160	70	8,390	6	1,760							
	40,000	24,000	16,000	10,800	27	10	2,400	52	8,400	8	1,350							
	50,000	30,000	20,000	11,050	22	10	3,000	40	8,050	10	1,105							
	60,000	36,000	24,000	11,300	19	10	3,600	32	7,700	12	940	② NORMAL CAPACITY						
	70,000	42,000	28,000	11,550	16.5	10	4,200	26	7,350	14	825	TEMPORARY COND - SEE NOTE 2						
ALL TYPES OF ELECT. CONST JOBS UNDER $15,000 VOLUME UP TO $120,000	50,000	30,000	20,000	18,250	36	10	3,000	76	15,250	10	1,825							
	60,000	36,000	24,000	18,300	31	10	3,600	62	14,900	12	1,540							
	70,000	42,000	28,000	18,750	27	10	4,200	52	14,550	14	1,340							
	80,000	48,000	32,000	19,000	24	10	4,800	44	14,200	16	1,185							
	100,000	60,000	40,000	19,500	19.5	8	4,800	37	14,700	20	975							
	120,000	72,000	48,000	20,000	16.5	8	5,760	30	14,240	24	838	② NORMAL CAPACITY						
	140,000	84,000	56,000	20,500	14.5	8	6,720	25	13,780	28	732	TEMPORARY COND - SEE NOTE 2						
SELECTED TYPE OF WORK LARGE PROJECTS VOLUME UP TO $300,000	120,000	72,000	48,000	43,750	36.5	10	7,200	76	36,550	24	1,820							
	140,000	84,000	56,000	44,250	32	8	6,720	67	37,530	28	1,580							
	160,000	96,000	64,000	44,750	28	8	7,680	59	37,070	32	1,400							
	180,000	108,000	72,000	45,250	25	8	8,640	51	36,610	36	1,255							
	200,000	120,000	80,000	45,750	23	8	9,600	45	36,150	40	1,146							
	220,000	132,000	88,000	46,250	21	8	10,560	41	35,690	44	1050							
	250,000	150,000	100,000	47,000	19	6	9,000	38	38,000	50	940							
	300,000	180,000	120,000	48,000	16	6	10,800	31	37,200	60	800	② NORMAL CAPACITY						
	350,000	210,000	140,000	49,250	14	6	12,600	26	36,650	70	703	TEMPORARY COND - SEE NOTE 2						

NOTES -
① COL. "K" SHOWS THE AMOUNT THAT MUST BE EARNED FOR EACH MECHANIC WORKING, TO COVER OPERATING COSTS
② BY WORKING OVER TIME, AN ORGANIZATION CAN TEMPORARILY HANDLE A VOLUME OF WORK IN EXCESS OF ITS NORMAL CAPACITY

ELECTRICAL CONTRACTORS' ASSN. OF CITY OF CHICAGO

Labor Burden as a Cost

Supplying and managing labor is a major expense to the contractor. Hence, labor should carry its share of operating costs. How these costs vary is shown in the table.

By Ray W. Ashley

Research Engineer
Electrical Contractors Association of City of Chicago

WHAT part does "labor burden" play in the total operating cost of an electrical contracting business? How does it vary with the type and volume of work done by a firm and what portion of the operating cost should it bear? These and other questions are answered by data compiled by the Research Department of the Electrical Contractors Association of City of Chicago.

Column "H" of the chart, illustrated in this article, shows estimated labor burden for electrical construction projects, based on the class and annual volume of business done by the contractor, varying from dwelling units and a $10,000 volume up to selected large projects and a total volume of $350,000. The division of total cost is assumed as 60 percent for material and 40 percent for labor with a basic rate of $1.00 per hour for mechanics. Salaries, office and general administrative expenses are assumed constant for each classification. The slight variation of total operating costs in each category is due to the change of business volume.

A study of column "E" shows that estimated operating cost (in percentage of total cost) decreases as the annual volume of business increases. It will be noted that these figures compare favorably with those established by other surveys. Such findings show why the "little fellow" should not step out of his own field to compete with the big operators.

Column "F" under Division of Operating Costs, shows that there is only a slight variation, in each classification, for material percentage. Column "H", however, shows a wide spread for that attributed to labor. This is logical since the major expense is supplying and managing labor, and such costs cannot be charged against material without presenting a false picture of operating costs.

Column "K" shows the amount, in dollars per mechanic employed, which the organization must earn to pay operating costs. It is just another method of showing:

(1) The necessity of electrical contracting firms operating up to the capacity of their organizations and equipment.

(2) The necessity of keeping operating costs within the limits warranted by the remunerative business a firm can secure.

Take, for example, a contractor organized to do an annual volume of $30,000. If he is operating at capacity, column "K" shows that he must earn

[Continued on page 88]

ADVANTAGES of

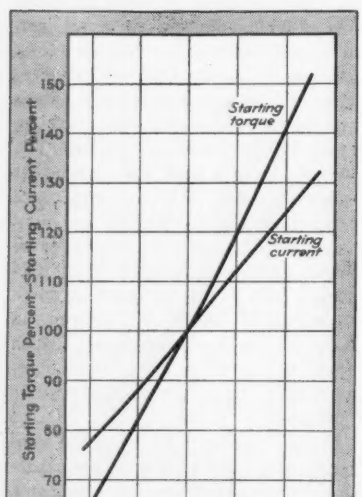
Increased voltage will give greater starting torques and more economical lighting while increasing system load capacity

THE recommendations of the War Production Board to increase the ratings on motors for new applications has brought up the question of starting torques and currents. If sufficient starting torque is not available the motor may be slow in coming up to speed with the attendant heavy starting currents lasting longer. It may not even start at all in which event the motor may burn up if proper protection has not been provided. Another freak occurrence which has happened in several instances is in starting a heavy load, the large starting current dragged on so long that one fuse blew allowing the motor to run single phase. The speed at the time the fuse blew, however, was sufficient to allow the motor to keep going and in due time the motor burned out.

Where starting torques seem to be insufficient, an increase in feeder voltage may remedy the situation. However, certain precautions must be taken and the entire situation should be carefully studied.

First of all the utilization voltage should be checked at various points over the entire plant, both near and far from the transformers and under no-load and full-load condition. It is important that the voltages be known under the varying conditions so that estimates may be made as to the effect of a 5 percent or 10 percent boost in voltage at either the power or distribution transformers. By the utilization voltage is meant the voltage at the terminals of the motor, welder, furnace or other equipment or the socket of the lamps. This actual utilization voltage should then be compared with the rated voltage of equipment and lamps. Then the voltage increase which can be permitted may be determined and the various resultant utilization voltages estimated. Incidentally all transformer taps should be checked so that it is known in advance just what and how much increase is available.

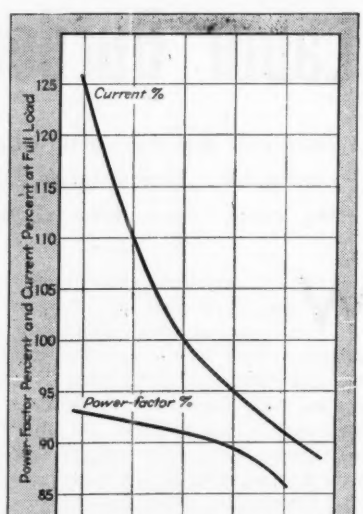
The accompanying curves will show the general trends that may be expected with deviations from rated voltage. Fig. 1 shows that increased voltage gives increased starting torques and starting currents. However, with increased starting torque, the motor will come up to full speed more quickly so that although the starting current is greater, its duration is much less. With a 10 percent increase of voltage a 20 percent increase in starting torque may be expected with a 10 or 12 percent increase in starting current. It will be noted also that at 90 percent rated voltage a decrease of 18 percent in starting torque below rated will be obtained. Perhaps this may be the cause of present starting troubles. With increased feeder loading, the voltage drop may have reduced terminal voltages. It is well to make a careful check with accurate instruments.



STARTING TORQUE AND STARTING CURRENT *increases rapidly with increased voltage. However, the greater starting torque will accelerate the load in a shorter period of time reducing the duration of heavy starting currents. (Fig. 1)*

Figure 2 shows that increased voltages give a decreased full load running current and also decreased full load power factor. Although in certain cases it is unpredictable just what running currents will do with voltage variations, in general the trend is as shown. A 10 percent increase in voltage will give about 8 percent decrease in running current while at 90 percent rated voltage the running full-load current may increase as much as 25 percent. Over the range from 90 percent to 110 percent rated voltage of the squirrel cage motor the full load power factor may vary by as much as 7 or 8 percent.

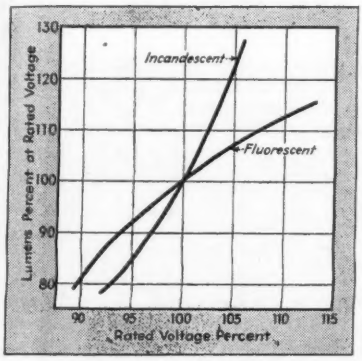
The most critical effects of voltage variation will be on lamps and much attention must be given to its symptoms. Figure 3 shows the lumens output in percent of output at rated voltage. If the utilization voltage is increased 10



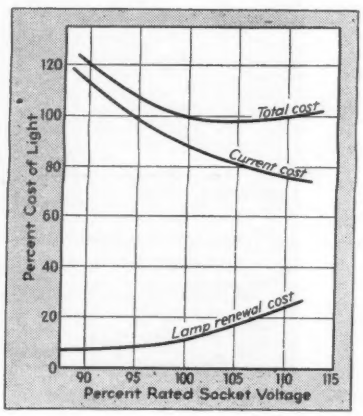
RUNNING CURRENTS *and* POWER FACTORS *may be expected to decrease with increased voltages. Running current variation with voltage depends largely upon design and so is unpredictable but the general trend is as shown. (Fig. 2)*

INCREASED VOLTAGE

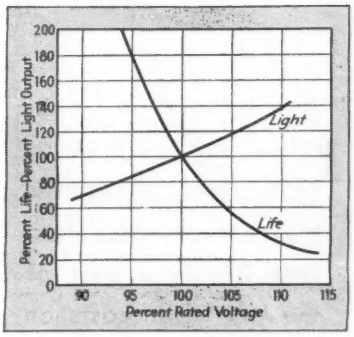
By R. E. Miller



LUMENS OUTPUT *for increasing socket voltage goes up faster for incandescent lamps than for fluorescent. This indicates that as the voltage drops below 100% rated, the output and likewise the lamp efficiency drops considerably. (Fig. 3)*



OPERATION COSTS *of illumination can be broken down into two parts, namely, lamp renewal cost and current cost. As voltage increases, lamp efficiency and output increases and current cost per lumen hours decreases. Even though lamp renewal costs increase considerably the total cost of operation at over-voltage is less than at under voltage. Since light is just as much a commodity as production raw material, it should be utilized to fullest capacity. (Fig. 4)*



RATED LIFE *of lamps drop with increased voltage but lamp output and efficiency increases. Rated life is defined as average life not the length of life of every specific lamp. For every lamp that burns out at 50% rated life, there is one which will last 50% longer than rated life.*

percent, fluorescent lumens output increase about 12 percent or 13 percent, while incandescent lumens increase by 50 percent or 60 percent. Figure 5 shows that an increase of 10 percent in socket voltage will just about immediately kill a mazda lamp. Its life will be reduced by approximately 65 percent. By contrast a reduction of 10 percent below rated voltage will triple its life, but further study will reveal that such operation is much less economical than operation at 10 percent over-voltage even though lamps need to be replaced more often.

Reference to Figure 4 will give an indication of the relation of voltage to the economics of operation. In computing total cost, only cost of operation was considered, namely, lamp renewal cost and cost of current. Installation costs of fixtures, feeders, panels, etc., were not included as they have no bearing on the operation voltage. It must be remembered that in computing lamp life and consequently lamp renewal costs, figures are based on averages, that is, at 100 percent rated voltage 100 percent lamp life is to be expected. This does not mean that *all* lamps will last this long. It does mean that for every lamp which burns out at 80 percent rated life another lamp will last to 20 percent beyond its rated life.

Referring to figure 4 at 100 percent rated voltage, 100 percent rated life is to be expected and the total cost of light operation is 100 percent. This total cost can be broken down into two costs, current and lamp renewal. Current cost constitutes 89 percent of the total while lamp renewal cost accounts for 11 percent making the total 100 percent. At 90 percent rated voltage, the total cost of light increases, due to the loss in efficiency, to about 120 percent (of what it would be if operating at 100 percent voltage) current cost 113 percent and lamp renewal cost 7 percent. Of the total cost of operating at this point, current cost constitutes 94 percent and lamp renewal costs 6 percent.

A 10 percent socket voltage increase would show that the total cost is again 100 percent, but the current cost constitutes only 75 percent of the total cost due to the increased efficiency and lumens output. Lamp renewal, it will be noted, has increased to 25 percent of the total.

The point to be emphasized is that the most economical operating voltage is about 104 percent of the rated voltage stamped on the lamp. It is often thought by many that more economical operation is obtained by increasing lamp life with under voltage, but lamp life is seen to be a minor consideration in total illumination costs. Light is a commodity and its cost is of real significance and importance.

Perhaps the most important feature of a complete voltage check over the entire plant is that it will probably reveal utilization voltages which are well below rated. From the above it is seen that much more is gained by operating over the mark than under. By juggling taps on both power and distribution transformers, the correct utilization voltage may be obtained to suit the particular operating conditions that exist. Generally, standard transformers have taps in 2½ percent steps, four above and four below normal. At distribution points where loading is exceptionally heavy or even over loaded, taps can be raised a step or two higher than at points of lighting loading.

The foregoing will give a fairly typical picture of the advantages to be gained through an increase of operating voltages and also what results are to be expected. However, each individual installation should be given full study after the indicated spot checks are made to find out just what present operating conditions actually are.

UMI

ESTIMATING SPECIAL BOXES and TROUGHS

A method of accurately approximating costs which recognizes that actual installation time is only a part of the job labor costs on special boxes.

By Leo Witz
Continental Electric Construction Co.
Chicago, Illinois

FORMULA: For estimating special boxes and troughs.
Man Hours = Length (in inches) plus Width (in inches) plus Height (in inches) multiplied by the multiplier selected.

MULTIPLIER:

Maunting	Sq. or Rect. Box	Eccentric Angle or shape
Wood	.035	.05
Masonry or Steel	.05	.06
Bolted Through 8" masonry	.08	.09
Bolted Through 12" "	.10	.11
Suspended from ceiling construction by means of prefabricated angle iron or rods and inserts	.10	.11

NOTE: TABLE IS BASED ON 1 CONDUIT AND SET OF CABLES ENTERING AND LEAVING ENCLOSURE. FOR EACH ADDITIONAL CONDUIT AND SET OF CABLES ADD .01 TO THE MULTIPLIER.

IT is very difficult to estimate the exact installation costs of special pull boxes and troughs because the preliminary work on the job often exceeds the actual labor of setting the equipment. In compiling the estimate, the estimator can foresee the necessity for such equipment; he can refer to "rule of thumb" tables and determine the recommended size, based upon the quantities and sizes of conduits and cables entering the equipment; he can check architectural and structural plans for installation conditions; but he then must normally assign an arbitrary man hour unit.

The reason that arbitrary man hour units are applied is twofold: First: the equipment, by its very nature, is special and it would be a virtual impossibility to have a dimensional sheet which would show all possible sizes and shapes of such equipment. Second: the type of installation which requires special boxes, etc., is usually "heavy" electrical construction, and the relative cost of installing special pull boxes, etc., is negligible in the overall labor installation. Since consistency is highly desirable in estimating, it is well worthwhile to use a fixed table or formula to determine the labor hours involved in such installations.

Any tables which would have a high degree of accuracy would have to be based upon box and trough dimensions, or box and trough weights. Checks on the square inch metallic content of the box, or the weights of the metals incorporated into it, are fairly accurate, but involve considerable "pencil work" on the square inch methods, and reference to sheet steel tables, gage, and square footage of the metal involved, on the weight methods.

The following formula appears very arbitrary, but checks well with the weight and square inch methods, and involves considerably less work.

To get a complete picture of the installation cost on which this formula is based, it is necessary to consider the job time spent in locating, measuring, ordering, and accepting the material upon delivery. In the event that this work is done by a field engineer, he is inevitably accompanied by the supervising mechanic, to coordinate the entire installation. When the equipment arrives, it is sometimes necessary to cut field knock outs because of shop error or changed layout.

It is well to remember that although the type of equipment under consider-

[Continued on page 137]

EXAMPLE: Square Box 24"x24"x10" mounted on masonry; 3 conduits and sets of cables in and out.

SOLUTION: 24 plus 24 plus 10 equals 58 multiplied by .07 equals 4.06 man hours.

Since the multiplier on one set of cables would have been .05 (see table above) the difference between the revised multiplier and the standard multiplier or .02 x 58 equals 1.16 man hours reflected in the total man hours for additional time at the box during the cable installation.

EXAMPLE: 90 degree angle pull box around masonry corner. Box 14" deep x 12" high x (16" plus 16") long; 1 conduit in and out.

SOLUTION: 14 plus 12 plus 32 equals 58 multiplied by .06 equals 3.48 man hours.

In the above two examples the same total dimension figure is used but a different multiplier is used because of the type of box and the additional cable in one of the boxes. If there had only been one conduit and cable set in each, the angle box would have taken .58 M. H. longer, which represents additional layout time.

TABLE 1 . . . Current Carrying Capacities of Standard Steel Pipe

Amperes at 30, 45 and 60 Deg. C. Rise, 60 Cycles

Pipe Size	UNSLOTTED PIPE						SLOTTED PIPE						COPPER PIPE (NEMA)	
	Indoor, Rise °C			Outdoor, Rise °C			Indoor, Rise °C			Outdoor, Rise °C			Indoor, Rise °C	Outdoor, Rise °C
	30°	45°	60°	30°	45°	60°	30°	45°	60°	30°	45°	60°	30°	30°
¾ in.	105	140	170	140	185	230	160	215	260	215	285	355	515	680
1 in.	125	165	205	160	215	260	180	240	295	235	315	385	675	860
1¼ in.	145	195	240	185	250	305	205	275	335	265	355	435	875	1130
1½ in.	170	230	280	215	285	355	235	315	385	295	395	485	1025	1285
2 in.	210	275	345	255	340	415	280	375	460	340	455	560	1300	1585
2½ in.	250	330	410	300	400	490	325	435	535	390	520	640	1700	2010
3 in.	290	385	475	345	460	565	370	495	610	440	590	720	2175	2560
3½ in.	330	440	540	390	520	640	415	555	685	495	660	810	2525	3040
4 in.	370	495	605	435	580	715	465	620	760	550	735	900	2850	3400

Capacities based on continuous service

STEEL as Substitute A.C. Conductors

Laboratory tests and investigation of steel substitutes for copper conductors led to the development of current carrying capacities for steel pipe and structural shapes.

By Stanley C. Killian and Allan A. Alsaker

Research and Development Engineer, Delta-Star Electric Company, Chicago

THE by-products of war are many and varied. When scarcity rears its ugly head, science begins to search for substitute materials. Such is the case in the electrical industry, hit squarely between the eyes by the wartime shortage of copper—the lifeline of electrical systems.

Aluminum and silver have been used in place of copper, but the former is a long recognized scarce metal and the latter digs deeply into the pocketbook. Hence we began to explore the possibilities of using steel, formerly employed to a very limited extent, as conductors for moderate alternating current capacities.

Our first investigation was with steel pipe. Two 12-ft. lengths, mounted 30-inches above the floor in a draft free room and 25-inches on center were tested for heat runs based on a 30 degree C. rise for comparison with copper and aluminum capacities. Five thermometers, at 3-ft. intervals measured the hot spot temperatures used to determine the rises. The average d.c. conductivity of the pipes tested was 11.6 referred to a copper base of 100. Table 1 shows the results of 30.45 and 60 degree C. rise tests with values rounded off for unslotted and slotted pipe. Outdoor current capacities were obtained by multiplying the indoor values by a factor obtained from a rounded ratio of outdoor to indoor copper capacities, using NEMA current-carrying capacities for copper pipe to obtain these ratios.

The d.c. conductivity of steel pipe, alone, means very little when a.c. capacities are to be considered. The a.c. power losses which contribute to conductor heating include: d.c. resistance losses, skin effect resistance loss, hysteresis and eddy current losses. Good bus engineering avoids running a.c. conductors through ferrous loops. Where the conductor is steel pipe, every filament of current is surrounded with a ferrous loop—hence there is local heating due to hysteresis and eddy current losses.

A large factor in the greatly decreased current capacity for steel as compared to copper is skin effect. In a nonferrous conductor, this is due to the many flux linkages at the center of the conductor as compared to the outside and, since flux linkages in steel are much more effective, the same condition is present to a much greater degree.

Newly galvanized pipe was used in the tests and checked against plain pipe, aluminum painted to produce approximately the same emissivity. There was no difference in current capacities. However, a 15 percent increase in capacity was noted when pipes were painted a shiny black. Dull black

UMI

TABLE 2 . . . Current-Carrying Capacities of Structural Steel Angles in Amperes at 30, 45, 60 Deg. C. Rise, 60 Cycles

Angle Size In Inches	Cross-section Sq. Inches (2 Angles)	Square Configuration □						"T" Configuration ⊥L					
		Indoor Rise °C.			Outdoor Rise °C.			Indoor Rise °C.			Outdoor Rise °C.		
		30°	45°	60°	30°	45°	60°	30°	45°	60°	30°	45°	60°
1½ x 1½ x ¼....	1.38	270	360	445	340	450	560	280	370	460	350	460	570
2 x 2 x ¼.....	1.88	350	465	575	440	580	720	375	500	615	470	620	770
2½ x 2½ x ¼....	2.38	430	570	705	540	710	880	470	625	770	590	780	960
3 x 3 x ¼.....	2.88	505	670	830	630	840	1,040	565	750	925	710	940	1,150
3½ x 3½ x ¼....	3.38	575	765	945	720	960	1,180	660	875	1,080	820	1,090	1,340
4 x 4 x ¼.....	3.88	635	850	1,040	800	1,060	1,300	750	995	1,230	930	1,240	1,530

Capacities based on continuous service

showed a higher increase. Current values between 100 and 115 percent of the table values would ensue if well-weathered galvanized pipe were used.

Another means of increasing the capacity is by slotting the steel pipe. Heating losses due to magnetic phenomena is reduced because, while a small ferrous flux path can exist around each filament of current, the slot prevents the union of all these flux circles into one large circle entirely inside the steel. Gains in slotted pipe capacities ranged from 26 percent for 4-in. pipe to 52 percent for ¾-in. pipe. A ⅛-inch slot was chosen as the optimum. Doubling the width of the slot showed only a 5 percent increase and would decrease the mechanical strength. The most economical means of slotting pipe is to use a flame cutter. Whether to use a small slotted or larger unslotted pipe for a given current capacity depends upon economic considerations.

Copper or bronze fittings, when used with galvanized steel pipe, should be coated or cadmium plated to prevent electrolytic corrosion.

Structural Steel Sections

The steel pipe investigation suggested the possibility of using structural steel sections as a.c. conductors, so the same procedure was repeated using various configurations of the popular angle section. Because of the importance of conductor contours in ferrous sections, wide variations in current-carrying capacity were found with different outlines, though the cross-sections were equal.

The current-carrying capacities derived from these tests are listed in Table 2, according to angle size and configuration. Angles in a square configuration were found to be more efficient than slotted pipe of a like cross-section. The "T" formation of angles showed an improvement over the square arrangement. Capacities evolved from tests on a "U" configuration of angles, with ½-in. spacing between, varied only slightly from those of the "T".

Avoidance of continuous radial flux paths in steel a.c. conductors is the basic problem. In pipe the path is both continuous and radial. The slot breaks the continuity but still maintains the radial field. The introduction of another gap in the angle square alters, to a limited extent, the radial condition; while the "T" more or less loses all symmetry and continuity. Another important factor, from the standpoint of temperature rise, is the ability of the section to radiate heat.

An optimum angle thickness of ¼-in. was chosen. Because skin effect allows only a small depth of current penetration in ferrous conductors, angles thicker than ¼-in. are less efficient; those thinner than ¼-in. usually are impractical from the standpoint of mechanical strength.

Here, again, tests were made with galvanized sections. Values in Table 2 also can be applied to aluminum painted sections. When the conductor is well weathered or covered with a paint of good emissivity, approximately 15 percent can be added to these values. The d.c. conductivity of the sections tested was 13 percent, as compared to 100 percent conductivity of copper.

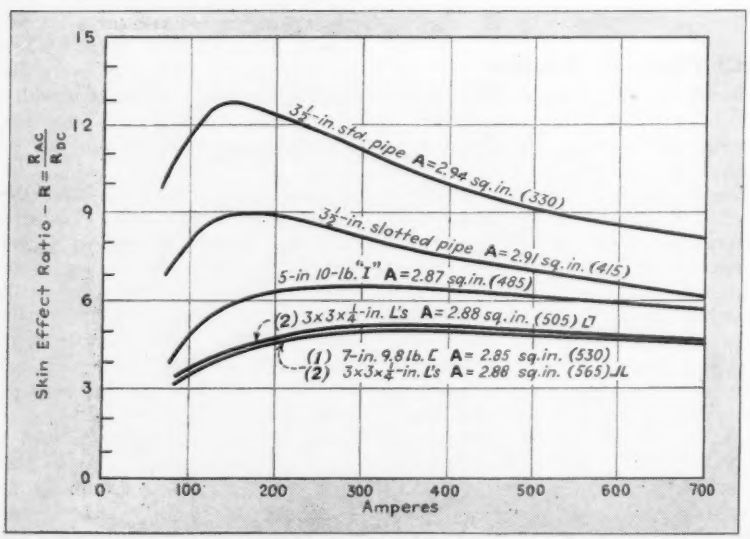


FIGURE 2—SKIN EFFECT RATIO *curves for galvanized structural steel sections predict the current-carrying capacity of the section. Numbers in parenthesis indicate indoor, 30 deg. C. rise ampere capacities.*

The results of tests made on various sized beams revealed that their current-carrying capacities, shown in Table 3, ranged from 10 to 15 percent less than that of angle "T" configurations having the same cross-sectional areas (Compare with Table 2). Indoor and outdoor capacities of these beams for other rises can be determined by applying similar ratios, which can be obtained from Table 2. All beams and channels shown in Table 3 have ¼-in. webs. A somewhat higher capacity per square inch, was revealed by tests on sections having smaller than ¼-in. webs.

Although better than beams on a cross-section basis, channels are poorer than "T" angles. The mechanical strength advantage of channels and beams over angles is offset by their lower capacities and, in some cases, by the more bulky connections required for splices and tap-offs.

Steel bars have the following disadvantages as conductors: thick sections must be avoided; thin sections have low capacity because of size, and skin effect lowers the capacity of multiple thin bars. Thick angles should also be avoided. Test results showed that single ¼-in. thick angles have capacities approximately half of the corresponding pair in "T" configuration. A single 3x3x¼-in. angle, 280 amps., has almost the capacity of a 3x3x⅜-in. angle.

TABLE 3 . . . Current Carrying Capacity of Miscellaneous Steel Sections

Amperes at 30 C. Rise, Indoor

Type of Section	Size of Section	Area in Sq. Ins.	Capacity in Amperes
I-beam	5"-10.0 lb.	2.87	485
H-beam	6"-12.0 lb.	3.53	620
H-beam	8"-17.0 lb.	5.00	850
Channel	4"-6.25 lb.	1.82	330
Channel	7"-9.80 lb.	2.85	530
Rect. bar	¼"x4"	1.00	210
Rect. bar	⅜"x6"	2.25	330
Angle	3"x3"x⅜"	2.11	290
Angle	3"x3"x¼"	1.44	280

Capacities based on continuous service

TABLE 4 . . . Current Carrying Capacity of Steel Sections Paralleled With Copper Bars

(¼-in. spacing between sections)

Amperes at 30 C. Rise, Indoor

Type of Section	Size of Section	Current Carrying Capacity		
		Steel alone	Copper alone	In Combination
One Copper bar One Steel bar	Copper — ¼"x4" Steel — ¼"x4"	210	1250	1070
One Copper bar Two steel angles back to back with copper between	Copper — ¼"x3" Steel — 3"x3"x¼"	565 (as a "T")	950	930

Capacities based on continuous service

Skin Effect Ratio

Skin effect, continuity of flux path and contour are the main factors to be considered in ferrous conductors. The results of tests made to determine conductivity efficiency of various steel shapes, all of approximately the same cross-section, are shown in Fig. 2. The value "R" represents the ratio of a.c. to d.c. resistance.

To determine the a.c.. resistance, a single phase set-up was made and readings were taken on a section of conductor. Voltage drop, current and watt-meter power values were recorded and translated into impedance, power factor and resistance. The curves are based on a 25-in. conductor spacing. Check tests on 12½-in. and 50-in. spacings revealed only slight variations. Therefore, for average accuracy, the curves can be considered as applying to an isolated conductor.

It should be noted that the resistance curves predict the current-carrying capacity of the various sections. Small discrepancies between the two test procedures are accounted for by the ability to radiate, a factor influencing the carrying capacity and not included in the effective resistance readings. Since "T" angles and channels showed almost the same results, only one curve is shown for these two sections.

All curves follow the familiar B-H pattern, the ratio increasing, due to increased permeability, as current is raised and then decreasing due to saturation as current is further increased. While 30 degree rise capacities are well beyond the curve peaks, it is interesting to find that the a.c. resistance of iron pipe could be as high as 13 times the d.c. resistance. "T" angles and channels show a maximum a.c. to d.c. ratio of only five.

Galvanized sections were used in the tests. The use of ungalvanized sections results in a considerably higher a.c. to d.c. resistance ratio.

Paralleling copper and steel sections to increase conductor capacity sounds feasible but might be misleading. The results of tests made along these lines are shown in Table 4.

Skin effect in copper due to a medium of high permeability next to it is greatly intensified. Because of this effect, the loss of usable current-carrying copper more than offsets the addition of steel as a parallel conductor.

Tests were also made on similar section arrangements, except that the conductors were back-to-back without any spacing between them. Members were bolted together at two foot intervals. Here the steel acts as a heat absorber for the copper, but the magnetic heating in the steel and skin effect in the copper are increased. These factors more than overcome the heat absorption gain and result in lower capacities.

Care should be taken, when operating steel conductors at 45 and 60 degree C. rises, to prevent heat transfer from the bus to other equipment rated at 30 degree C. maximum rise. It would be poor practice to connect a 60

(Continued on page 139)

W. T. Stuart, Editor

Job Freeze

The new rules set up by WMC on April 17, provide for a certain procedure in the hiring and lay-off of men. For most of the readers of these columns the rules relating to workers engaged in essential activities will be most important. The revised list of essential industries includes construction (No. 8) and repair services (No. 31).

Workers previously engaged in essential activity cannot be hired at a higher wage rate, except where the hiring is permitted under an employment stabilization program approved by WMC. Transfer of workers between jobs is further inhibited by the requirement for a statement of availability which the worker must have before he can be hired.

The worker's previous employer or the WMC may issue the statement of availability. It must contain the worker's name, social security number, the name and address of the issuing employer or the WMC office, and a statement that the workers may be hired elsewhere in an essential activity. No other information may be given on the statement.

What complications the new rules will bring in meeting the varied manpower requirements on construction jobs is still to be determined. The frequent shift of workers from one employer to another as job needs vary is more the rule than the exception. Rates vary in different areas and men must flow from one area to another as they are needed.

The new regulation will probably be followed by a number of procedural amendments. It has apparently been written around the major manpower problems, war manufacturing and agriculture. As usual it is implemented with drastic penalties, for employer and worker, applying to technical as well as deliberate violations. So it is important to keep in contact with your local WMC office if you are hiring or laying off men.

The job-freeze order has been interpreted as a National Service Act by executive order. It does not, however, dictate where any worker must seek employment. It does, however, control his movements from one job to another. Whatever it may be called, it closes down drastically on much of the freedom American workmen have enjoyed in this total war.

Specialists Wanted

In these columns we have often urged those who can, and feel their war service could be more effective that way, to sign up as specialists in the armed services. All of the fighting forces—Army, Navy, Marines, Coast Guard—need men with specific skills.

We have received occasional comments on such advice, and naturally, we get them from the people who have applied for service and have been turned down. Disregarding those who were indignant that the Army did not need a Colonel with their particular qualifications, the burden of protest seems to center around the form letter indifference frequently encountered. The enthusiastic offer of personal skill being received by what appears to be thoughtless ignorance of its potential importance arouses protest and a feeling of frustration.

A little thought of what the job of lining up men for this war means will help. War is a methodical business. Men must be placed in specific jobs with specific skill requirements. There just isn't time to arrange the procedure to fit thousands of special abilities even though they may appear logically very useful. The form letter rejection may be sent, and probably is, by an officer perfectly competent to judge whether the applicant can fit into the pattern.

On the other hand there should be, in the development of an armed force which must be drawn from civilian manpower, agencies which can steer the man who wants to give what he feels is a special ability to his nation. Civilians in general cannot know all the needs of the services. They cannot know the multitude of special jobs which require their specific skills. But civilian experts trained in the requirements of the armed services could. Such stories as that in the *New Yorker* of the expert linguist who wound up taking care of carrier pigeons are giving a lot of useful specialists a what-the-hell attitude toward requests for skilled men.

Absenteeism Must Be Curbed

With bulging pay envelopes and long hours the problem of absenteeism is becoming a serious menace to job schedules. The overall national problem can be visualized by a statement recently made that a reduction in absenteeism would be the same as adding 3 million workers to our manpower supply.

The problem isn't easy. It can only be thoroughly controlled by some form of national service act and severe regimentation. This is a high price to pay. Britain has such a system. Absenteeism is controlled by a labor committee, enforced by its recommendations to the courts.

Can we find a better way? It is a challenge to management and labor organizations alike. It is unlikely that anyone wants regimented labor. But to avoid it we must cut absenteeism and keep it to a minimum for the duration.

Forgetting the Horse

Last month Chicago held a War Production Clinic. It was a huge all-day affair drawing a crowd of 2500 industrial representatives and comprising some 24 panel discussions covering everything from machine shop practice to wage disputes.

UMI

But it was not complete. There was one conspicuous flaw—a missing link that is vital to continuous production. Electrical maintenance was not mentioned in the entire program. It was like polishing up the wagon and forgetting the horse.

This is a serious error that has been carried through the years. The electrical system and equipment always appear to be the last to be thought of. Yet without it not a gear would turn; not a plane, tank, or gun would come off the assembly lines. And without systematic maintenance of these life lines, danger always lurks ahead and production will suffer.

Maintenance electricians are full of ideas and "kinks" that keep plants operating during emergencies. Indianapolis discovered this during the electrical maintenance panel sponsored by the local Electrical League at their WPB Clinic.

Other Clinics can profit like Indianapolis, if someone will only take the responsibility of including an electrical maintenance panel. And that someone should be the local electrical association. It should be consulted when Clinics are planned. WPB will welcome such cooperation for the purpose of these meetings is to exchange ideas on all phases of plant operation and production—and that includes electrical maintenance.

Five Years Old

Five years ago we saw some of the preliminary evidences of a new electrical product. It was introduced with glowing promotion. It held promise of a bright future. The dreamers went a bit wacky over the new baby—but the old hands were modestly cautious.

After all there was a long established product already in the field, doing a splendid job. A great industry had grown up with it. The technique of design and planning and layout, too, had developed with it. This newcomer would have to be good just to break into the same league.

The newcomer, fluorescent lighting, was good; so good, in fact, that its enormous growth in five years is probably an all industry record, unmatched as far as we know by any other product and unparalleled in industrial history.

When you look down the unending line of fluorescent lamps lighting the greatest production effort of all time, as you pass through stores and offices, drafting rooms and groceries, the enormous impact on our lives of this virtual infant of electrical development begins to add up. The men who created it deserve the glory of contributing enormously to the advance of civilization. But some credit, too, must go to the great complex industry which, in five short years, took fluorescent lighting into the market place and put it to work.

NISA Growing

A recent announcement from the headquarters of the National Industrial Service Association shows the largest membership in its history, 555 members. The progress that NISA has brought to the electric motor service industry goes far beyond its membership rolls. And in these days when NISA is cooperating closely with Washington departments in formulating and interpreting rules, the whole industry is concerned.

The percentage of present NISA membership to the potential is fairly high. Dues are deliberately low and the range of activities has something for every active shop. There are still many, however, who could be contributing to these activities and who benefit from NISA's organized efforts who should be in the fold.

Vacations in Wartime

Donald Nelson has given official sanction to vacations for war workers this year. He believes that war production in the long run will be helped. And experience has shown that a reasonable time to restore energy through a period of physical and mental rest brings the worker back in better shape to tackle his job.

But the production goals this year are twice those of 1942. Vacations cannot be allowed to reduce the objective. The wartime vacation will probably have to be shorter than usual and the burden on management will be greater. But the proceeds in improved work will pay dividends when the year end pressure to meet the production quota comes.

In construction activity the problem is complicated by the varying demands for labor on individual projects. Intervals between jobs of slack periods give the mechanic an interval when his absence will have the minimum effect.

Washington Comments

Recent pronouncements of WMC takes the Washington spotlight for the most important development.

Elimination of 3-B in Selective Service follows out a long term plan. Married men without children are being moved to 1-A or deferred by occupation in other classifications. The next move will probably eliminate all but exceptional dependency deferments.

The job-freeze is discussed elsewhere on this page. It isn't "National Service" but comes close.

An order just issued grants a usefully high priority to farmers who need wiring materials to hook-up farm machinery. This is a logical step, frequently urged here, and has everybody's blessing.

Prentiss Brown's statement eliminating the requirements for reports on estimates and prices under MPR-251 is the swan song of that regulation. Construction, already limited to projects under other government regulations, is hardly a serious threat to inflation control plans. NECA was in the forefront against MPR-251.

Joint conferences of contractors and labor will soon be examining postwar prospects and plans on a national scale and in the major metropolitan areas. The inseparable interdependence of business and employment opportunities makes the joint labor-management approach especially important.

The probability of separating OCS from the control of WPB material allotments has about the same chance as the proverbial snowball. Nevertheless, top shelf men in WPB are aware that a little more critical materials and components here and there in the civilian scene are vital to keeping the home front in working order.

Talk of reaching a point of saturation in manufacture of war materials with consequent release of facilities and materials in great quantities for civilian needs is most wishful thinking, according to the experts. The rate of growth in production will level off, probably this year. But there will be no decline nor release of war plant capacity. Any civilian products program will be carried out in unconverted capacity. There is still some available.

Construction projects halted by revocation of preference ratings to the middle of April total 1⅓ billions.

UMI

Methods

BRIEF ARTICLES about practical methods of installing and maintaining electrical wiring and equipment and up-to-date estimating and office practices. Readers are invited to contribute items from their experience to this department. All articles used will be paid for.

SEQUENCE SWITCHING SAVES EQUIPMENT

WIRING

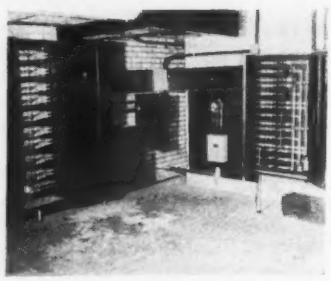
With the rapid expansion of industrial facilities and war production, many plants and even essential office buildings found it necessary to rehabilitate and enlarge their electrical systems—in many cases doubling or tripling the size of the original service. But with the critical materials situation as it is, service entrance equipment in large sizes is exceptionally difficult to obtain.

To circumvent this bottleneck the Electrical Inspection Dept. of the City of Chicago collaborated with local utility engineers and contractors to develop a "sequence switching" type of service in which the disconnects of the main distribution cabinet are tied directly to the service buses. The following are the features and limitations of this new method:

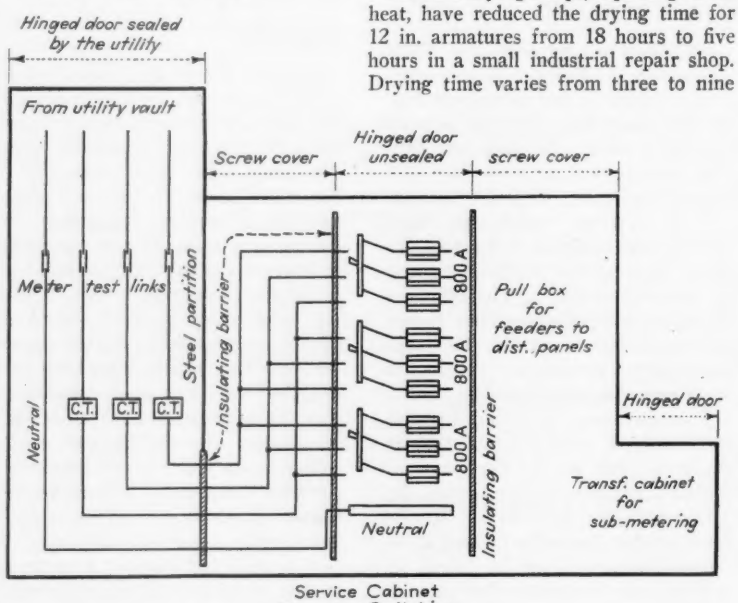
1. It eliminates entirely the conventional entrance-service switch or circuit breaker which normally protected only the short run of bus from the switch to the distribution cabinet.
2. It is approved for services of 1,000 ampere or larger capacity.
3. The number of switches in the main distribution cabinet is limited to six; maximum capacity to be 800 amperes, minimum 400 amperes.
4. These disconnect switches or circuit breakers must be definitely identified with the panels they feed, so they can be used as isolating switches in case of emergency.
5. Service buses must carry ultimate load of the building and feeder cables must carry full capacity of the feeder switches.
6. Meter current transformers and meter test links are inserted in the buses between the service point and the feeder switches.
7. Open buses and metering current transformers on the line side of the feeder switches are sealed and accessible only to utility representatives.
8. Feeder switches and everything on their load side are accessible to the owner's representatives.

This sequence type of switching, covered by section 2351a of the National Electrical Code, is nothing more than the breaking up of a large service switch or circuit breaker into several smaller units. In addition to the omission of the conventional entrance service switch, this system eliminates the hazards attendant upon the opening and closing of large capacity switches and breakers—under load in emergencies.

Such a service—or "hot sequence job," as some contractors have dubbed it—was recently installed by the Super Electric Construction Company, Chicago, in a rewired Chicago office building taken over by government agencies. The circuit arrangement in the service cabinet is illustrated. The three 800-ampere fused knife switches feed sub-distribution panels. The main buses come in direct from the utility underground street vault.



SWITCHBOARD ROOM showing sequence switches (left) feeding two sub-distribution panels at right, each containing five 200-amp., 3-pole fused knife switches. Feeder cables are enclosed in steel troughs. Meter shown is for sub-metering purposes.



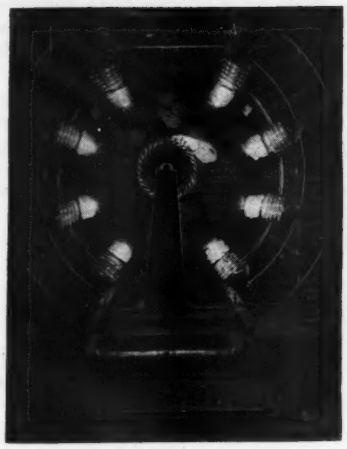
***SEQUENCE SWITCHING** eliminates the conventional entrance service switch or breaker. Main panel switches are tied direct to utility secondary buses as shown. Everything to left of these switches is sealed and accessible only to utility men. System is 120/208 volt, 3-phase, 4-wire.*

INFRA-RED CUTS ARMATURE BAKING TIME

INDUSTRIAL

Radiant drying lamps, replacing steam heat, have reduced the drying time for 12 in. armatures from 18 hours to five hours in a small industrial repair shop. Drying time varies from three to nine

UMI



A TWELVE INCH armature is being baked in the reconditioned steam oven now utilizing infra-red lamps. Time of job has been cut to one-third of previous time.

hours for armatures from six to 24 inches in diameter.

A total of 120 infra-red 250-Watt reflector drying lamps are arranged in tubular form in two equal adjustable banks. Three 10 kw. sections, each consisting of eight groups of five lamps, permit three armatures to be baked simultaneously or individually. Heating temperatures range from 240°–260° F. as compared to 185°–200° F., with steam heat. Power supply is single phase, 3 wire with individual 30 ampere switches controlling the 24 five lamp grouping, a total of 30 kw.

The wall construction of the old steam oven remained intact in the revamping. The only changes made were the removal of the steam pipes, the doors and the venting in the roof. Each bank of lamps is supported from the roof on barn door slides, which permits the lamps to be adjusted to the proper distance from the armature surface.

CABLE MAINTENANCE

INDUSTRIAL

In view of the fact that copper cables are all but impossible to get, it behooves every maintenance engineer and electrician to maintain existing cables in A-1 condition. These present service cables may be required to last much longer than their normal life.

Where cables are unnecessarily exposed to possible damage, it may be feasible to reroute them. Chafed, bruised or worn places should be promptly repaired and properly protected. If connections, terminals or supports need attention it is unwise to put it off. Protection from heat may be obtained either by moving the cable, or source of heat. Light, ozone, moisture and oil are all detrimental to cable insulation. If such conditions exist, prompt installation of proper protection is vital.

The following specific means of increasing the carrying capacity of cables are suggested by the Simplex Wire and Cable Co.:

1. Use of highest practicable operating voltage.
2. Use of two or more smaller cables in parallel instead of one large cable in certain cases.
3. Improving thermal dissipation conditions.
   a. By eliminating thermal bottlenecks.
   b. By forced ventilation.
   c. By soil wetting.
   d. By re-location of sources of external heat.
   e. By cable re-routing.
   f. By avoiding close grouping of a number of cables and spreading them to dissipate heat.
4. Improving power factor of load.
5. Locating transformers to reduce length of secondary cables.
6. Increasing allowable line drops wherever conditions permit, thus conserving copper.
7. Operating all existing circuits at full allowable loadings, re-connecting spare and partially loaded circuits, where possible, to accomplish this.
8. Salvaging miscellaneous lengths removed during repair and alterations for re-use at other locations.
9. Using buried cables instead of duct cables where practicable.
10. Using cables exposed in air in preference to cables in conduit where practicable.
11. Selecting cables on a basis of normal operations rather than for occasional overload.

DESIGN FOR MAINTENANCE

WIRING

The proper hanging of fluorescent fixtures to enable easy maintenance is very often a problem of primary importance. Marvin P. Foreman, electrical superintendent and L. F. Spang design engineer for Wertz Engineering Company of Reading, Pa., did a fine job in this respect on a recent "conversion to fluorescent" installation. A poorly lighted high-bay storage building was to be converted into a high quality illuminated machine tool shop. The high-gabled bay made it impossible to use ceiling hung fixtures and so a messenger cable system was employed. However, instead of the usual design whereby the messenger carries the conduit parallel to it, the conduit is carried at right angles giving a more or less rigid network.

The messenger was strung longitudi-

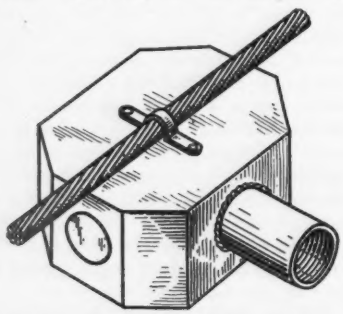
***PREVENTIVE MAINTENANCE** through inspection to avoid altogether or at least anticipate trouble is being carried out here by two maintenance engineers in one of General Electric's manufacturing plants. Commutator, brushes, and brush ring connections are being checked on a large d.c. generator.*

Methods

[FROM PAGE 49]

nally from brick wall to brick wall and was anchored to each end by through eye bolts, thimbles and clamps. The cable height was such that it laid across the building rafters which were spaced on 15-foot centers 15 feet from the floor, thus taking a good share of the strain off the end walls.

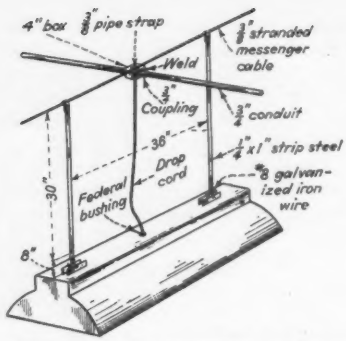
The hangers were made 30 inches long from No. 16 gage by one inch strap steel. The strap steel was salvaged from binders used in shipping sheet steel to the Wertz Engineering Company who are general contracting engineers in other fields as well as electrical. One end of the hangar was



STANDARD COUPLING welded to 4-inch box to insure against conduit loosening decreasing network rigidity.

bent into a U shape, drilled, and bolted fast to the messenger. The other end was drilled to accommodate No. 8 galvanized iron wire which was also bent U shaped with a hook bent on each end. The hooks then slid into the holes of the uprights on the ballast case. The removal of the fixture is accomplished merely by squeezing the wires together, disengaging the hooks from the holes. This maintenance feature was one of the first considerations incorporated in the original design. A three-wire twist lock receptacle was used to facilitate the complete removal of the fixture.

The four inch boxes were made up (as shown in the sketch) at the shop. A close nipple was run into a standard ¾-inch coupling which was welded to the box. A lock nut and bushing were then turned onto the nipple inside. The same procedure was applied to the opposite side of the box and a pipe strap loosely attached to the bottom. The boxes were then ready to go to the job where they were screwed securely to the conduit, wire pulled and receptacles wired. Each full length as it was readied was hoisted up into place where it was



DETAILS OF FIXTURE hanging showing strap steel hangers and galvanized wire hooks which releases fixtures for easy maintenance.

strapped securely to the messenger. Fixtures were hung and plugged in, completing the job. The welding of the couplings to the boxes was done to insure rigidity and to insure against lock nuts and bushings coming off and dropping out the conduit.

Fixtures take off the 220 volt 3 phase circuits in sequence in order to balance current load and correct stroboscopic effect.

The result of this careful design was an economic installation which afforded quality illumination and good maintenance encouraged by the readily accessible fixtures.

PURCHASED POWER FREES PRODUCTION SPACE

INDUSTRIAL

Space is at a premium these days, especially manufacturing space. The Victory Glass Company, Jeanette, Pa., secured 'free' space for a parts cleaning department a short time ago.

At that time the company changed over to purchased power. This move released the old engine room for productive services and saved the cost of an addition. (This addition would have been impossible to get without a long time delay period.)

CASTINGS being finished and inspected in the 'extra' production area at Victory Glass Company.

Relief of a serious plant bottleneck, however, was an even more important result of the new power policy. Previously, all Victory employees had to be sent home every time there was an interruption in the generating service and as a result the work piled up. Purchased power, according to the plant president now insures full time operation for all his workers.

REMOVING VARNISH FROM A BRACKET FIT

INDUSTRIAL

The following method is used by Westinghouse Electric Manufacturing Company at their Lima, Ohio, plant. The idea is sound so it is passed on to you.

After parts have been dipped in varnish and baked it is necessary to remove part of it from the metal. This is sometimes done by sanding or buffing but if the parts are identical and in large numbers, other methods may be quicker and more thorough.

A hollow mill supported from a stand and counter-balanced for ease of operation is used to remove varnish from the bracket fit of small motor frames. The cutter is lowered until a pin in the slide nut engages in the lowest notch in the guide. The cutter is rotated manually and the desired pressure is supplied by turning a hand wheel. When the bracket fit has been properly cleaned, the pressure is released; the slide nut is disengaged from the pin, and the cutter is pulled upward by a counter-balancing weight.

A shell cutter is required for each frame size. A side clearance on the teeth is omitted to prevent the diameter of the frame fit from being affected. To keep the depth of the cleaned surface constant four of the 12 teeth have no back clearance. A spring under the handwheel cushions the cutter to permit starting on irregular surfaces, thus compensating for any misalignment.

ADJUSTABLE SCREWS INCREASE BELT LIFE

INDUSTRIAL

To keep guiding tightener pulleys on the top of sensitive drill presses in line, and thus lengthen the belt life, a scheme has been devised where adjusting screws replace the flat steel springs for retaining these pulleys in position. It is only necessary to drill and tap a hole through the spring retainer stud to use the adjusting screws. The belt is run over

UMI

Timely tips from the Wartime Lighting Front

Salesgram

BOB BISHOP
SALES MANAGER

SYLVANIA ELECTRIC PRODUCTS INC.
Salem, Mass.

Incandescent Lamps
Fluorescent Lamps
Fixtures, Accessories
Radio Tubes
Electronic Devices

WHAT'S THE INDUSTRIAL LIGHTING OUTLOOK FOR THE REST OF '43? F. W. Dodge estimates look mighty good. Non-residential building from April through December will run around $1,500,000,000 -- $500 MILLION a quarter. Sure, war building is declining, but 1943 will still beat a boom year, 1940. Real business for those who go out and get it.

SYLVANIA'S "FIXTURE OF THE FUTURE" is what the trade has been waiting for. One industrial fixture that is completely adaptable. Single or continuous row mounting. Any type of hanging. Simplifies installation and maintenance as well as stocking. Watch for announcement soon.

WPB DECENTRALIZATION is expected to speed issuance of PD-1A's. Soon we'll be submitting applications to local regional boards instead of Washington. Present ceiling (lighting expenditures not more than $100) will be lifted until regional offices pass on at least 80 per cent of all PD-1A's.

WPB LIMITATION ORDER 1-28 (as amended March 30, 1943) pegs exact amount of incandescent and fluorescent lamps to be produced by each manufacturer in a given period. SYLVANIA received green light to furnish fluorescent lamps WITH OR WITHOUT PRIORITY RATING. But majority incandescent purchases must carry AA-5 priority or better. Caution: limit orders wherever possible to AA-5 priorities or better.

WATCH FOR A NEW FLUORESCENT STARTER. Soon SYLVANIA will announce glow-type fluorescent starter. Advanced design. Positive starting. maximum lamp life. Also a new cut-out-type starter is coming in the wartime line.

HELP AMERICA TRANSPORT THE STUFF OF VICTORY by conserving vital transportation. Delivery time that normally took one week now takes two and even three. Accordingly, plan and order your stocks as far in advance as possible.

SPECIAL FOR INDUSTRIAL ACCOUNTS. By popular demand, SYLVANIA, in May, goes into volume production on its fluorescent HANDYLITE. Boon to war plants. Glareless illumination from cool source for close inspections. Portable. Readily hookable. Light without shadows, for hard-to-get-at places.

* * *

We'll be looking forward to seeing you at the NEWA convention in Buffalo.

R. H. Bishop

UMI

[FROM PAGE 50]

the pulleys in the conventional manner with the pulleys allowed to take whatever position they will. The set screws are then run down tight and locked in place by means of a lock nut.

The pulleys cannot shift from their position unless the screws are loosened. In this manner, the belt is made to run true and its life is lengthened.

BRAZED BUS JOINTS

WIRING

Oxidation of busbar joints has always presented quite a problem to the electrical maintenance man. Sufficient contact area between connecting bars is provided by a lap equal to at least the bar width, but before the joint can be made the adjoining faces of the lap must be carefully faced and thoroughly cleaned. Since the daily heat cycle of a bus system entails an uneven expansion and contraction of the different metals (bolts, clamps and copper), the adjacent faces at the joints are alternately tight and loose, allowing surface oxidation with an increase of the resistance of the joint. The voltage drop across this joint also increases, causing more heat dissipation and rapid oxidation, resulting in a further increase of resistance. Careful maintenance can of course prevent this vicious cycle condition, but to make a worthwhile job of it, the joint must be completely dismantled periodically, contact surfaces thoroughly cleaned and the lap reassembled. Further maintenance is entailed in checking nuts for tightness. A wide variation in the heat cycle and vibration may require that nuts be checked quite often. All this only adds to maintenance operation costs.

LAP PLATES are held in position with four C clamps and all four plates are brazed at once. When the brazing alloy begins to flow, clamps are tightened an extra turn to obtain as thin a silver bond as possible.

RIGHT ANGLE joints are made with two flat plates and a right angle piece. Strength tests showed a larger margin of safety against short circuit stresses.

To obviate this situation B. Altman and Company, New York City department store used a brazed busbar system. Three inch square ventilated bus was used due to space limitations, and a considerable saving in copper was realized. Four copper plates 2-in. by 6-inch by ¼-inch were used to lap each straight joint. Two plates and a right angle piece were used to make each 90 degree joint.

Prior to brazing, bus joints and plates were thoroughly cleaned and a fluxing compound applied. A sheet of Sil-Fos 0.010 thick and the size of the plate was then placed between the bus and lap plate. All four plates were then clamped into place by the use of four clamps and heat applied by a multi-tip acetylene torch. The Sil-Fos brazing alloy (15 percent silver, 80 percent copper and 5 percent phosphorous) has a low flow point of 1300 degrees F. which permits quite a saving of gas. The moment the alloy begins to flow each clamp is tightened further to give a stronger, thinner silver joint. Sheet alloy is preferable to rod also for gas saving purposes in addition to assurance of an even distribution of the brazing alloy. Rod can be fed in under the plate and capillary attraction will draw the liquid alloy into the space between bus and plate but more skill on the part of the operator is required and distribution of the alloy beneath is never known.

Ebony asbestos blocks were used along with bar iron and channel hangers for support. Midway of the horizontal run a braided copper connector shunt was provided to take an estimated 2-inch maximum expansion. Subsequent to brazing, all joints and the entire bus was coated with a lacquer to accelerate cooling. A test run on the bus fully loaded to 3300 d.c. amps. gave a 17 degree C rise. Under the same loaded condition, a potential drop test showed 0.5 millivolt less drop across a 12 inch length including a brazed joint than across a 12 inch length of all copper bus. This has been explained to be due in part to the brazing alloy reducing contact resistance and in part to the increased mass of copper in the joint.

Cost analysis on a per joint basis showed brazing to be about 40 percent of the cost of directly bolted flat bus and 30 percent of the clamp and bolt method.

Davidson Electric Co. and M. Eisenberg and Brother were the contractors who installed the bus work. E. L. Tressel, Ass't. Chief Engineer for Altmans, has expressed complete satisfaction in the superiority of brazed bus over bolted bus in maintaining top operating efficiency of the feeders.

INFRA-RED CARBONIZES CLOTH

INDUSTRIAL

Production is speeded and costs are lowered by using two banks of infra-red lamps to reduce shives, burrs, and vegetable matter to carbon in a large New England woolen mill. Used in place of a $10,000 convection type baker, the infra-red heating cabinet cost $1,000 and consists of two banks of 250-watt, Westinghouse infra-red lamps. The banks comprise 175 lamps each in rows 5 inches apart on six-inch centers. Passing through the infra-red baker at a speed of 25 yards per minute the cloth is exposed to the rays for about 20 seconds.

CLOTH CARBONIZER uses closely spaced infra-red lamps in two banks.

UMI

A NEW

Electro ENGINEERING TRIUMPH!

FLUOR-O-MASTER PRODUCTS

THE METAL-SAVING *Fluor-O-Master* BOMBER

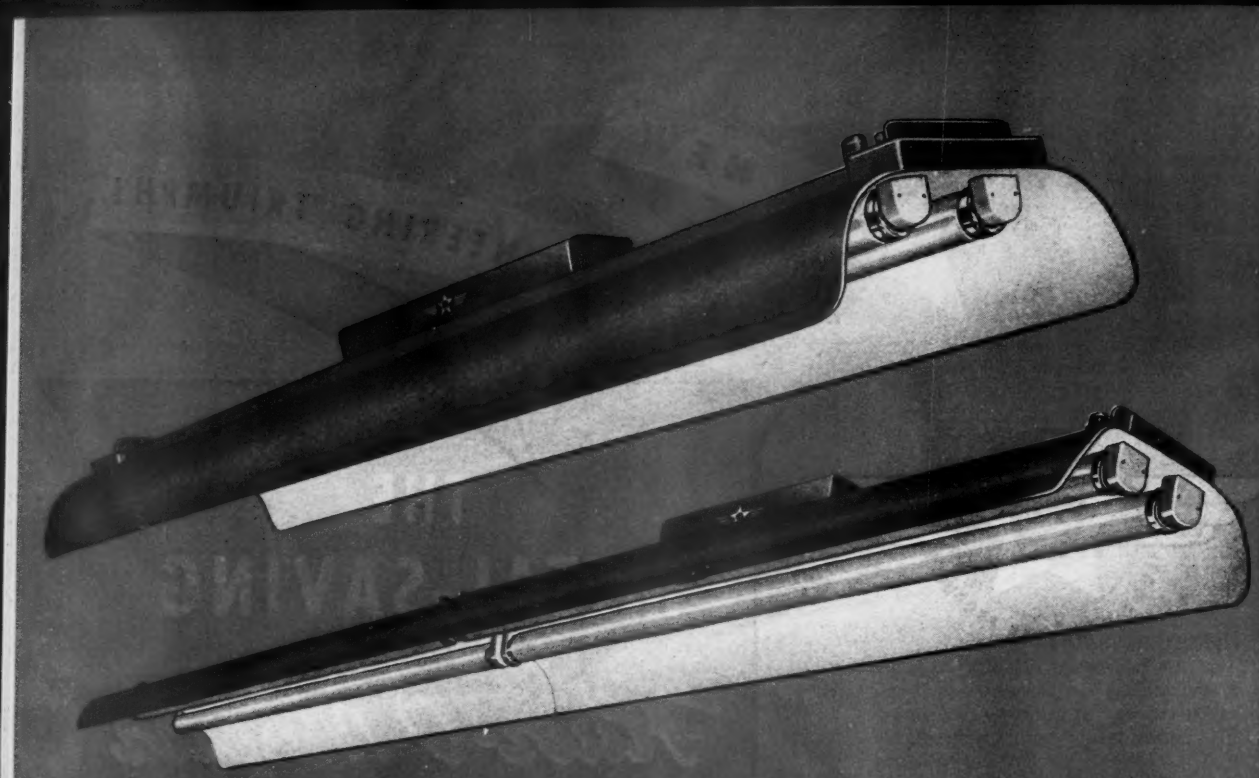
FOR CONTINUOUS AND INDIVIDUAL INSTALLATIONS

SEE NEXT PAGE

only 2 1/4 POUNDS OF METAL IN MODELS FOR 40-WATT LAMPS ☆ only 3 1/4 POUNDS OF METAL IN MODELS FOR 100-WATT LAMPS

ELECTRO MANUFACTURING COMPANY

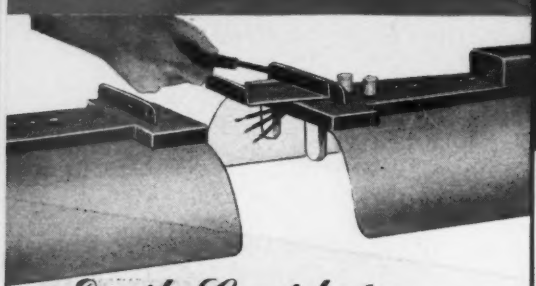
2000 WEST FULTON STREET ☆ CHICAGO



From 1 to 70 miles of

Fluor-O-Mastex

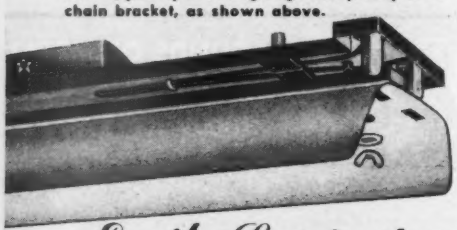
Light the way to Victory in Each of these Giant War Industries



Easily Coupled

FOR CONTINUOUS INSTALLATION

Channel sections are easily paired together with simple coupler, providing unobstructed wireway the length of the row. Units are firmly united, just by screwing angle-strap coupler to chain bracket, as shown above.



Easily Serviced

Reflector may be quickly removed to expose all wiring, just by releasing one wing nut at each end of channel. Wiring is fastened to channel. Starters are easily accessible on top of channel. All wires are eyeletted for attachment to terminals.

Vultee Aircraft Corp.	Consolidated Aircraft Corp.
Armstrong Cork Corp.	Bohn Aluminum Corp.
Victory Ordnance	Douglas Aircraft Corp.
Buick Motor Co.	Curtiss-Wright Co.
Bell Aircraft Corp.	Sampson U. S. Naval Training Station
Willis Overland Co.	
P. R. Mallory Co.	Port Deposit U. S. Nav. Tra. Sta.
Tacoma Shipyards	Chrysler Dodge Chicago Plant
Ford Motor Company	Hudson Motor Co.
Timken Axle Co.	North Amer. Aviation
Boeing Aircraft Corp.	Cadillac Motor Co.
Great Lakes Naval Training Station	Packard Motor Co.
Nash-Kelvinator Corp.	Naval Aviation Supply Depot

Triple Guarantee

U. L. INSPECTION LABEL **FLUOROLIER CERTIFIED**

ELECTRO GUARANTEED

UMI

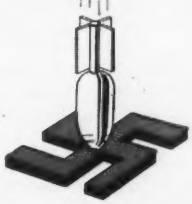
Fluor-O-Master BOMBER

CONTINUOUS AND UNIT LIGHTING

A MASTERPIECE

OF ECONOMY
VERSATILITY
AND ALL-AROUND PERFORMANCE

10,000,000 POUNDS OF METAL TO BLAST THE AXIS WILL BE SAVED IN '43 ON THESE FLUOR-O-MASTERS



10,000,000 pounds of metal will be saved this year by Electro for guns, tanks and aircraft, thanks to the unique construction of this new Fluor-O-Master.

America's best engineered fluorescent. Provides highest level illumination in a broader working area, at remarkably low operating cost.

LESS METAL IS USED IN ITS CONSTRUCTION THAN IN ANY COMPARABLE FLUORESCENT. It actually surpasses in material-economy the restrictions of Order L78, dated Jan. 26, 1943. Only 2¼ lbs. of metal are used in models for two and three 40-watt lamps, and only 3¼ lbs. in those for two 100-watt lamps.

Yet these Fluor-O-Master Bombers are sturdier than ever. The new metal chassis has as much strength as those of earlier models. Every feature is engineered for durability. Shakeproof lock-washers are used on all screws as a precaution against loosening caused by factory vibration. Patented socket-braces prevent sockets from twisting. Wiring is firmly secured to the top of channel to prevent touching Reflector. All wires have eyeletted ends for connection with terminals . . . a typical example of Fluor-O-Master refinement of small details.

Fluor-O-Master's exclusive white "Liquid Plastic" reflector surface, provides highest obtainable reflection factor (85% or more guaranteed). It is considerablymore brilliant than vitreous, and is glareless, more durable. Unlike porcelain enamel or vitreous, it is guaranteed for life against chipping, crazing or cracking.

A feature of special interest is the new AIR-COOLED BALLAST, which is mounted on top of the channel. This increases life of the ballast by dissipating heat more rapidly. The ballast is installed *right-side up.*

When coupled end to end, Fluor-O-Master Bomber channels comprise an enclosed, uninterrupted wireway for continuous lighting.

SEND FOR 8-PAGE CIRCULAR DESCRIBING MODELS FOR TWO AND THREE 40-WATT LAMPS, TWO 100-WATT LAMPS, AND TWIN SECTIONS.

ELECTRO MANUFACTURING COMPANY

2000 WEST FULTON STREET • CHICAGO

UMI

Motor Shops

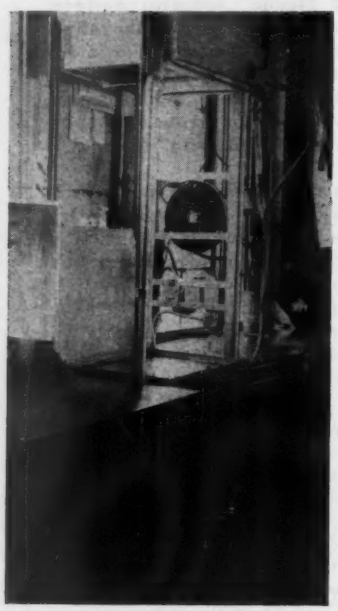
TOTALLY ENCLOSED SPRAY TANK

To keep the surrounding shop area clean and free of fumes, motor parts in the small motor department of the Willey-Wray Electric Co., Cincinnati, Ohio, are cleaned in a totally enclosed pressure spray tank. The tank is so designed that the cleaning fluid is constantly recirculated during the cleaning operations.

The device consists of a steel cleaning chamber, 18-in. wide, 18-in. deep, 24-in. long, and equipped with a double hinged cover. One is of transparent lucite in a steel frame to permit the operator to see the equipment he is spraying. The second cover is of sheet steel which protects the lucite when the tank is not in use. A curved nozzle on the end of the spray hose fits through a hole drilled in the top of the tank front and permits the operator to direct a 30 pound spray to any part of the cleaning chamber. Incandescent lamps, shining through lucite windows on either side of the tank, illuminate the parts being cleaned.

LUCITE COVER on cleaning chamber permits operator to see what he is doing. Incandescent lamps with lucite lenses on sides of tank provide illumination.

The liquid recirculating system consists of a large storage tank mounted high above the cleaning chamber and equipped with a double layer excelsior and sawdust filter in a canvas sack. After spraying the work, the liquid passes from the cleaning chamber through two removable screen strainers into a receptacle underneath the chamber. After the larger particles of dirt are removed in this manner, the cleaning fluid is pumped into the upper filter and storage tanks for reuse.



SPRAY CLEANING in the small motor repair department of this motor shop is done in this totally enclosed cleaning chamber with a recirculating cleaning fluid system.

THREE-WAY REFERENCE

Scherer Electric Company, Inc., Indianapolis, Ind., maintains a three-way cross reference record of its motor repair jobs. Job records are filed in the following categories:

1. Job numbers.
2. Size of equipment.
3. Name of customer.

With this system, records of jobs performed ten or fifteen years ago, can be unearthed at a moment's notice.

Another time saving scheme in the Scherer shop is a large record book containing rewind data on practically all of the motors available, especially those of odd size, discontinued models, special characteristics, or other unusual features. This record, which looks like a huge ledger, is set on a sliding shelf beneath a table in the center of the Rewind Department, where it is handy at all times for ready reference. Running back and forth to office files is eliminated and the lost time put into productive labor.

A duplicate copy of the book is kept in the office safe as a precaution against the other one being lost or destroyed.

FLOATING TEST GROWLER

Testing for "shorts" or "opens" in cage type armature windings was somewhat of a problem, so the Electrical Engineering and Construction Company of Des Moines, Iowa, designed a floating growler to facilitate this work.

The growler is mounted inverted to an angle iron platform which rides up and down in an 11-inch by 9½-inch frame, 34 inches high and made of 2-inch angle iron. This movable platform is suspended by four steel cables riding on pulleys at the top of the frame and mounted to the lower frame braces by four coil springs.

The armature cradle at the top of the frame consists of two 1-inch steel rollers, 10 inches long and mounted on 5½-

GROWLER FLOATS on a spring-cable suspended platform in this test unit. Cage type armature rests on roller cradle permitting slow rotation during test. Voltmeter on frame gives visual indication of open or shorted armature bars.

UMI

NEED MOTORS OR GENERATORS?

IF you need motors or generators, write or wire us . . . or consult your nearest Crocker-Wheeler office. We can make *immediate* deliveries on some types . . . but regardless of type, we can deliver in faster time than ever before.

New and vastly increased productive facilities, plus expert Joshua Hendy planning are the reasons. Crocker-Wheeler Electric Mfg. Co., Ampere, N. J. Division of JOSHUA HENDY IRON WORKS

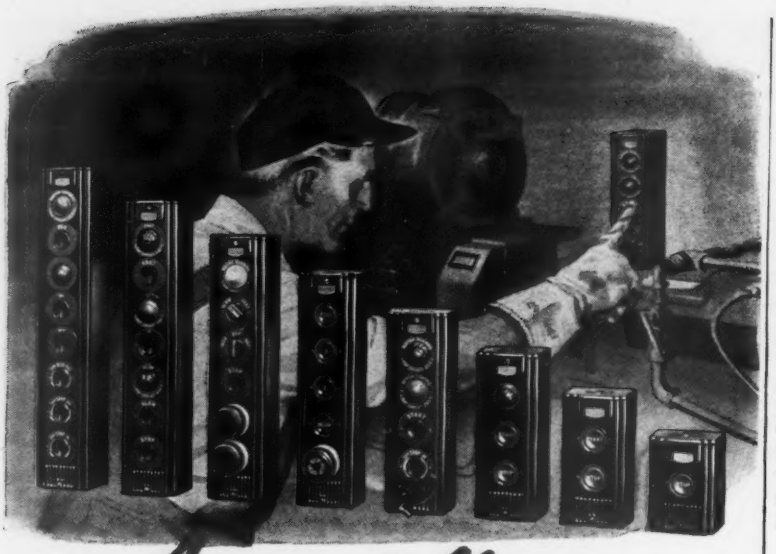
CROCKER-WHEELER

TRADE MARK REG. U. S. PAT. OFF.

Be SURE . . . with
CROCKER-WHEELER

Other JOSHUA HENDY IRON WORKS factories at Sunnyvale, Pomona and Torrance, California and St. Louis, Mo.

UMI



Answers to Many Pushbutton Control Problems

Cutler-Hammer's New Wide Range Line of Heavy Duty Pushbutton Stations offers an Unlimited Variety of Functional Combinations

● Now Cutler-Hammer offers a new line of Heavy Duty Pushbutton Stations (NEMA Type 1) for surface mounting and for flush mounting. The surface mounting enclosures accommodate from 1 to 8 Cutler-Hammer new unitized pushbuttons; the flush mounting constructions accommodate from 1 to 3 C-H unitized pushbuttons. The line provides the widest selection of functions and combinations available today and permits these stations to be "tailored" to your exact needs.

Among the many advanced engineering features are the following: one to 4 circuits for *each* pushbutton; wide variety of operators; big buttons for gloved-hand operation; projecting shatterproof color caps for 180° visibility; fitted "flange-seal" covers for extra sturdy and tight enclosure; rugged yet light weight construction; ample internal free space for easy wiring despite small size; no sharp corners or edges; excellent appearance; optional padlocking feature. Stations may be mounted horizontally or vertically. Write for further details today. CUTLER-HAMMER, Inc., 1306 St. Paul Avenue, Milwaukee, Wis. *Associate:* Canadian Cutler-Hammer, Ltd., Toronto, Ontario.

SOME OF THE OUTSTANDING FEATURES OF THIS LINE

Wide choice of operating elements with one to 4 circuits each, indicating lights, selector switches, etc.

CUTLER-HAMMER
MOTOR CONTROL
C-H

[FROM PAGE 56]

inch centers. These rollers turn freely and permit the armature to be slowly rotated during the test.

The actual test unit consists of a large growler and small auxiliary growler which picks up the induced voltage of the larger unit. A small voltmeter, 0–10 volt range, mounted to the stationary frame measures this induced voltage. Normal reading for a perfect armature is approximately four volts. A drop in the meter reading as the armature is rotated indicated a shorted or an open bar.

Armatures up to 50 hp. size are accommodated on this test set. When the smaller armatures extend below the level of the cradle rollers, the growler sinks with the weight of the armature permitting it to rest on the rollers. For the larger armatures, the coil springs raise the growler sufficiently to make contact with the bars. The entire unit is fairly light in weight so it can be moved to any part of the test department. Added portability can be had by mounting casters to the base of the frame, after making certain the base is broad enough to prevent accidental tipping.

SMALL DYNAMIC BALANCING UNIT

All small motors repaired at the Sullivan Electric Co., Cincinnati, Ohio motor service shop, are dynamically balanced before assembly and delivery. This phase of shop operation is done quickly and accurately on a new machine just installed—a product of the Bear Manufacturing Co., Rock Island, Ill.

The balancer requires very little space and is mounted by angle iron supports to the brick wall of the shop to eliminate any vibration that might occur if it were mounted to the wood floor. Operation of the unit is exceptionally simple and works on the spark coil principle.

The two armature upright supports are equipped with floating cradles (2—see photo) on which the armature shaft rests. When an armature is in perfect balance these cradles will remain stationary; when out of balance, the centrifugal force of the excess weight will cause the shaft to fish-tail and the cradles will vibrate back and forth making and breaking an electrical contact in the uprights. The knobs, (3) in the uprights are for adjustments to make electrical contact with the floating

UMI

YOUR WAR PLANT LIGHTING WILL NOT FAIL

Continuous operating schedules—vital to uninterrupted war production—intensify the need for industrial lighting equipment that assures efficient, economical lighting under all conditions. Proper lighting speeds seeing, reduces accidents and spoilage, helps workers sustain production speed and production quality.

This is no time to experiment with unknown, untried, unproven products. It is a simple matter to eliminate all risks of lighting failures. Insist on industrial lighting fixtures built to RLM Specifications . . . certified by the RLM LABEL. Industrial Lighting Fixtures made in accordance with RLM Specifications are designed and constructed with that extra safety factor vital war plants should demand of their lighting equipment. They assure highest lighting efficiency, maximum power conservation, lowest maintenance costs and greatest protection against lighting equipment failures. These porcelain enamel reflectors are unaffected by mechanical strains, smoke fumes, grime, dust and atmospheric conditions . . . are non-porous, easily cleaned, fadeproof, non-peeling and non-breakable. For full particulars write any manufacturer of RLM Industrial Lighting Units, or RLM Standards Institute.

The RLM Label Has Stood as a sign of Quality in Industrial Lighting Reflectors for More Than 20 Years!

The Letters RLM Stand for Reflector and Lighting Equipment Manufacturers

RLM STANDARDS INSTITUTE
INCORPORATED

Solder Prohibited

IN WIRE JOINTS

Wherever Wire Connectors

Containing No Copper or Copper Alloys

Can Be Used

COMPLY WITH GOVERNMENT REGULATIONS

Government Departments or Agencies which have issued orders, specifications, or recommendations to discontinue the use of solder type joints, are listed below:

- Critical Construction Materials Design Guide, Feb. 19, 1943, page 23 Section E.
- War Dept., Office of the Chief of Engineers, Section XXXIV, Oct. 20, 1942, page 34-02.
- W.P.B., War Housing Manual, Dec. 12, 1942, page 31, article 370.
- Army and Navy Munitions Board, Bulletin Jan. 1, 1943, To Supply Services, Etc., page 19, article 5.

IDEAL Wire-Nuts

MEET ALL GOVERNMENT REQUIREMENTS

● We are passing along this information as we know every man in electrical work will want to comply with the requirements, by discontinuing the use of wire joints which require either solder, copper, or copper alloys — and help conserve critical metals.

AN ALTERNATE AND IMPROVEMENT

for Solder and Tape—

"IDEAL WIRE-CONNECTORS"

IDEAL "Wire-Nuts" (Solderless, Tapeless Wire Connectors) contain no copper or copper alloys—therefore meet all requirements mentioned above. Easy to apply; strip wire, screw on, that's all! Cut costs, speed war work, and make a neater, stronger, better joint than solder-and-tape. Millions in Use! IDEAL "Wire-Nuts" are FULLY APPROVED. Listed by Underwriters' Laboratories, Inc. Sizes for All Joints from two No. 18 to three No. 10 solid or stranded wires.

If your Electrical Jobber, hasn't a supply kindly write or wire, mentioning jobber's name

→ PROMPT DELIVERY ←

IDEAL COMMUTATOR DRESSER CO.

1041 PARK AVENUE ★ SYCAMORE, ILLINOIS

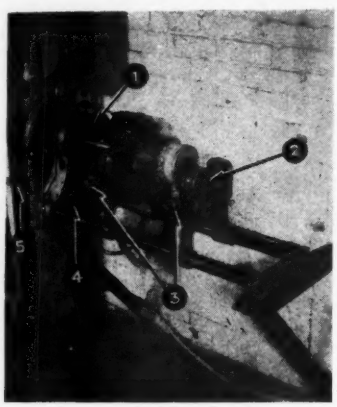
Sales Offices In All Principal Cities

Motor Shops

[FROM PAGE 58]

cradles. When the cradles are stationary these contacts remain on "make" and no spark appears on the spark indicator (4) at the lower left of the unit. If the cradles move, each time the contact is broken a spark appears on the indicator, showing the point at which weight must be added.

Just where weight must be added is indicated by the large numbered wheel (1) to which the armature shaft is coupled. This acts like an automobile distributor and has a contact behind each number which corresponds to that on the spark indicator. While the armature is spinning, the operator watches the indicator and the number at which a spark is maintained is the point on the armature at which weight must be added —or weight can be removed from the rotor at a point diametrically opposite this number on the large wheel.



***DYNAMIC BALANCER** for small armatures has following features: (1) numbered distributor wheel on shaft; (2) floating armature cradles. (3) adjustment knobs for floating cradle electrical contacts; (4) visual spark indicator, numbered to correspond with shaft wheel; and (5) hand brake. As armature spins, the number at which a spark is maintained shows the point at which weight must be added.*

A toggle switch on the unit controls the ¼ hp., 3-phase driving motor and a hand brake (5) facilitates stopping the rotating armature after the motor has been shut off. Shaft speeds can be varied from 500 r.p.m. to 1,800 r.p.m.

With this unit, each end of the armature is balanced separately. When perfect balance is attained, the motor is ready for assembly. Armatures up to 18 inches in diameter and with a maximum shaft length of 26 inches can be accommodated. Larger balancers for larger motors are available.

UMI

CENTURY
Mechanically and Electrically Balanced
MOTORS

Are Remarkably Free From Vibration

Century Motors' unusual freedom from vibration and exceptionally quiet operation are the result of careful electrical and mechanical balancing. In machine tool applications this contributes much to the accuracy of the work produced and is an important factor in prolonging motor life.

1. **Century rotors are dynamically balanced on both ends.**
2. **The electrical and magnetic circuits are symmetrically constructed to produce an even torque.**
3. **Slots are skewed to produce a steady torque — eliminating jerks.**
4. **Cushion bumpers deaden the thud of the shaft shoulder against the bearing when the rotor moves lengthwise.**
5. **Sleeve bearings are diamond bored for accuracy after they are assembled in the end bracket.**
6. **Bearing surfaces on the shaft are ground to close tolerances and highly polished.**

Such details of Century engineering, design, and construction help to produce quieter, free-running motors. Whatever the application, there are Century Motors built to stand up under the toughest demands of present day production.

Your nearest Century Application and Service Engineer will gladly give you full details on all the advantages of Century Motors — help you to select the correct motor to meet practically every application demand.

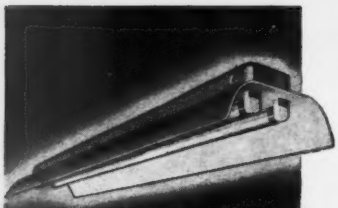
CENTURY ELECTRIC COMPANY
1806 Pine Street St. Louis, Missouri
Offices and Stock Points in Principal Cities

309

Century MOTORS

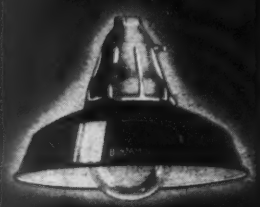
1/6 to 600 horsepower

One of the Largest EXCLUSIVE Motor and Generator Manufacturers in the World



BENJAMIN
Type V non-metallic reflector
FLUORESCENT LIGHTING UNITS
for 48" and 60" lamps

BENJAMIN RLM DOME
Incandescent
LIGHTING UNITS



BENJAMIN DUST-TIGHT UNITS

BENJAMIN EXPLOSION-PROOF UNITS

BENJAMIN FLOODLIGHTING PROJECTOR

BENJAMIN SOCKETS

It Pays

in improved workmanship
increased production
increased safety
reduced spoilage

To Watch Your Lighting

New needs for better lighting in specific departments for specific operations in your plant manifest themselves in the course of actual production experience. Constant vigilance and the periodic use of the services of trained Benjamin lighting specialists will reveal these opportunities. With war production experience* so strongly corroborating the scientific laboratory findings relative to the vital importance of lighting production, safety and manpower problems, it pays to watch your lighting to insure it is up to par all the time!

**For survey of war plant experience, see new I. E. S. report: "Value of Good Lighting in War Production"*

6 WAYS TO USE BENJAMIN LIGHTING EQUIPMENT

For Lighting Improvement and Lighting Equipment Maintenance

1 PROVIDE MORE LIGHT
Production experience often reveals the need for more light for certain operations, especially where detail is fine, for inspection, etc. such as is provided by Benjamin Fluorescent units.

2 REDUCE MAINTENANCE TIME
Dust and dirt on lighting reflectors can waste 50% and more of the light. Considerable time can be saved and constant lighting efficiency more easily assured in dusty and dirty locations by equipping units with Benjamin dust-tight covers or use of enclosed lamp units such as the Glassteel Diffuser, Dust-Tight units, etc.

3 IMPROVE PLANT PROTECTION
Get Benjamin recommendations for providing a protective fence of light around your plant and grounds. Or for improving your outdoor floodlighting for protection against sabotage and illegal entry. The new Benjamin Floodlighting Projector Type RDS and other units are available for this purpose.

4 REDUCE FIRE HAZARDS
Where explosive vapors or explosive dusts are present in the atmosphere, absolute protection against fire or explosion from the lighting equipment can be obtained through the installation of Benjamin Explosion-Proof and Dust-Tight Units.

5 SPEED NIGHT YARD WORK
The better lighting provided by Benjamin special outdoor lighting units for loading platforms, work areas, stock piles, etc. enables men to work faster, surer and more safely. Get Benjamin recommendations and lighting layouts for such areas.

6 MAINTAIN LIGHTING LEVELS
Keep your lighting system in full operation at all times by making repairs when needed to secure the maximum benefits of a good lighting system. Replace burned out and blackened lamps, worn out or damaged sockets, reflectors and other parts so that the levels of lighting will be maintained on a constant basis. Benjamin lighting maintenance items are available for this purpose.

BENJAMIN ELECTRIC MFG. CO., Dept. H, Des Plaines, Illinois

BENJAMIN TRADE MARK

Lighting Equipment

UMI

Industrial Electrification

ENGINEERING · INSTALLATION · MAINTENANCE

RELEASED CAPACITY

CONSERVATION of critical materials confronts every one of us with the problem of doing a good job in attaining desired objectives with only the material on hand. A much easier way is allowing a bad condition to exist, hoping for the breaks until delivery is made on new material and equipment which will rescue us from our dilemma. However, a little time and effort will prove a means to the same end. For example, capacitors may be ordered by a mere stroke of the pen. Yet the expenditure of a certain amount of time and effort, valuable though they be, will result in complete load data sheets which should reveal keys to this same end—power factor improvement.

Low power factors can be considerably corrected by careful study of existing conditions with the necessary readjustments and reapplications. Then if further correction is desired or required, capacitors and leading power factor synchronous machines may be added. In this manner, the use of vitally needed critical materials in corrective equipment is held to a bare minimum.

The accompanying article goes into much detail of the many sources of low power factors and what can be done about them.

Previous articles covered—

- Electrifying Operations to Reduce Unit Costs
- Safety Protection for Electrical Operations
- Increasing Flexibility of Electrical Service
- Electrical Aids to Automatic Control
- Electrical Ways to Reduce Waste
- How to Save Power
- Protection Against Sabotage
- Improving Working Conditions
- Electrifying for Continuous Operation
- Electrified Plant Housekeeping
- Electrical Problems Under 168 Hour Schedules
- Electrical Aids to Plant Conversion
- Electrical Aids to Quality Control
- Electrical Aids for Green Help
- Codes in Wartime
- Grounding for Safety
- Air Raid Restoration
- Operating Replacements
- Preparing for Blackouts
- Wiring for Quick Changes
- Power Factor Improvement (this issue)

Future articles will discuss—

- Welding in Industry
- Salvaging Electrical Equipment

POWER FACTOR IMPROVEMENT

THE circulation of magnetizing current between the generator and its load results in an energy loss and a reduction of the power transmission capacity of the wiring system. High power factor is essential to highest efficiency. Conversely low power factor causes excessive voltage drop, poor circuit regulation, and brings about difficulties in maintaining the desired voltage of the generator.

Of the many methods by which power factor may be raised, the first which comes to mind is the capacitor, and then the synchronous motor. However, in these days of scarcity, it is timely to consider what might be accomplished by improved operation of whatever apparatus there is on hand, and without resorting to the purchase of corrective apparatus.

Survey

The best way to ascertain system power factor would be to have the supply company make the measurements. They too are vitally affected by power factor of customers' loads, and are always pleased to give advice to those desiring to improve such conditions.

A complete system survey would provide a graphic record of the load power factor which, used in conjunction with a log of shop operations, would show up those loads bringing about low power factor.

In the recent case of a small precision machine shop there was a power load of 47 kva. at only 37 percent power factor. This was not exceptional, but only indicative of what happens when many grinders and other machines are run at extremely light loads.

What power factor should be aimed for? Generally, 90 percent is found to be satisfactory. From a given power factor, the amount of required corrective kva, decreases up to about 85 percent above which the required amount increases.

The economical limit is around 90 percent, high enough for satisfactory voltage regulation.

Wiring Systems

Insulated conductors should be kept close together for lowest reactance and consequent voltage drop. For years the required spacing between 251-600 volt open conductors was four inches, but the recently-issued National Electrical Code Supplement reduced this requirement to two and one-half inches. Where lines are being reinstalled, advantage should be taken of this helpful aid toward higher circuit power factor. To give some idea of the importance of power factor in system design, a circuit carrying a given kw. load at 80 percent power factor will have to dissipate about 56 percent more loss than when carrying the same kw. load at 100 percent power factor.

Electrical Contracting of October, 1942 published an article on the improvement of voltage by the use of new cable lines to a cement mill. An 80 percent reduction in circuit reactance resulted from the reduced spacing of the conductors in cable compared to the original overhead open lines. The overall system power factor was raised from

UMI

52 to 71 percent by this reduction in feeder reactance.

If lead-covered cables can be used, so much the better, because their capacitance effect helps to raise the system power factor and overcome the inductive reactance of open wiring feeders. Cables have greater charging currents than overhead lines of the same length and voltage because, for one reason, the dielectric constant of cables is several times as great as air.

The reactance of a circuit is often of greater importance than its resistance, particularly with larger cables, starting at about No. 4/0. It becomes especially important with cables above 500,000 CM. Triangular spacing of open wiring has advantages over flat construction in improving power factor, because circuit reactance is kept at a minimum.

Busways are available for low power factor loads such as welders, their special design being for low reactance. One manufacturer's 3000-ampere busway has a reactance which is less than its resistance. This is remarkable considering the large size of conductor. Where long buses have to be rearranged, the chance to improve power factor by closer spacing, perhaps with barriers between, should not be overlooked.

The connections of loads of different power factors to different lines might present a chance to make better use of circuit capacity. If practicable, loads of low power factor should be supplied over low reactance feeders, such as conduit systems; and if there are higher reactance open-wiring circuits, connect to these the higher power factor loads. The accompanying Guide Sheet shows how load power factor partly governs circuit capacity.

In existing plants the cost of increasing the size of a feeder or the added cost of a new feeder to carry additional load may be saved at times by improving the power factor at the load if the power factor is low. This saving in cost may go a long way toward paying for power factor improvement.

Lighting

Where voltage disturbances are being caused by large low power factor currents such loads should be segregated and supplied over feeders separate from the lighting mains. This would not improve the system power factor, but it would at least keep such disturbances off the lighting circuits. Another way of avoiding such voltage disturbances would be to place these low power factor loads close to the supply transformers.

High power factor lighting equipment should be used because uncorrected fluorescent lamps draw twice as much current as corrected units, which means four times the power loss in the circuit wires. High power factor units cut the voltage drop in half. For the 40-watt units, the two-lamp ballast, which has a power factor of 95-99 percent actually costs no more than two uncorrected single-lamp ballasts.

Since an unloaded transformer operates at an excessively poor power factor, often as low as 10 percent, it is obvious that a proper choice of transformer to best meet the average load

A. BAD ACTORS on power factor such as this band saw can be evened off by electric power tools B, driven by capacitor motors (which also give good torque).

condition, as well as carry the peaks, is extremely important. This applies more than ever with so many plants deriving their lighting supply from many transformers located throughout the premises. Not only has the tendency to install too many individual transformers had an adverse affect on power factor, but has resulted in heavy transformer core losses. Too many small units eliminate the benefit of load diversity.

Generally, there is a very limited choice in most shops as to the particular furnace or welder which may be employed for any operation. It must be pointed out, however, that resistance type furnaces tend to improve the power factor, whereas arc furnaces or the induction type in which the charge forms the short circuited secondary have high reactance and low power factor.

Arc welders employ reactance in their operation and consequently have low power factor. To avoid the disadvantages of low power factor, such as poor circuit regulation, a.c. arc welders should be purchased complete with built-in power factor corrective equipment.

Resistance welders which use very large currents, also have high reactance and cause very low power factors. Where individual welding machines are resulting in low power factor, it might be well to consider the use of a constant voltage machine to supply a group of welders. Such a smaller central outfit being more fully loaded should have improved power factor. Of course, there would be the disadvantage of added losses if individual resistances were required at each working point.

The newer energy storage electronic control method overcomes large, low power factor currents, electric energy being stored in capacitors for discharge into the welding transformer. This type of welder has but a small kva. demand compared to a conventional machine.

Infra-red heating should not be overlooked. It has very high power factor, and such an outfit is relatively simple to operate. It might be that the use of infra-red would allow for the shutting down of some other heating process requiring more load at a lower power factor.

Motors

The greatest cause of low power factor is underloaded motors. Motors should be selected for highest practicable speed and minimum horsepower rating, to conserve material, to obtain a better operating efficiency, and at the same time maintain good power factor.

For example, a 20 hp. 1800 r.p.m. motor might be expected to have a full-load power factor of 90 percent compared to 80 percent for a 720 r.p.m. machine. At one-half load these values would drop to around 88 and 65 percent power factor respectively. Where a slow speed motor can be replaced by one of higher speed, there lies an opportunity to better the power factor.

Another way of looking at these facts is to consider that a fully loaded induction motor requires an exciting current equal to approximately one-third of the full-load current. At one-half load, the exciting current equals the load current.

UMI

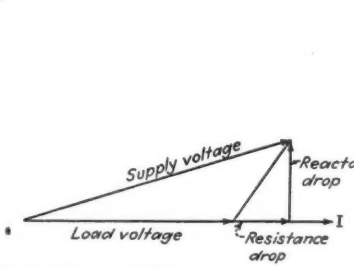
MAINTENANCE GUIDE SHEET

Pertinent Data for Power Factor Improvement

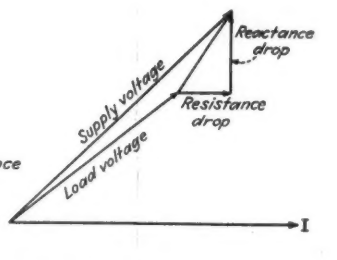
GUIDE TO IMPROVE PLANT POWER FACTOR

(1) Make a system survey of load power factor and compare with a log of shop operations.
(2) If 251-600 volt open conductors are reinstalled, spacing may be reduced to 2½ inches.
(3) Triangular spacing of open wiring minimizes circuit reactance.
(4) Use busways designed for low reactance.
(5) With fluorescent lighting systems use ballasts to provide high power factor.
(6) Disconnect from high-side, transformers that are lightly loaded.
(7) Avoid using too many small transformers.
(8) Check possibility of reducing demand peaks.
(9) Stagger starting of electric equipment
(10) Select type of motor and control equipment suited for the drive.
(11) High-speed induction motors have higher power factor and with speed reducer are preferred to direct-connected low-speed motors.
(12) Use single-speed rather than multispeed motors, preferably single-winding rather than two-winding where multispeed motors are essential.
(13) Rearrange motors so that they will be operated at or near full load.
(14) Use modern group drive instead of individual drives with several small motors, where the system is suited.
(15) Shut down induction motors and motor-generator sets when not needed.
(16) Use synchronous motors instead of induction type for constant-duty drives.
(17) Capacitors improve power factor at point of connection to line and back to source of power supply.

Diagrams to Illustrate Effect of Power Factor on Voltage Over an Inductive Circuit



Power factor = 100%
Supply voltage = 1.3 times load voltage



Power factor = 77%
Supply voltage = 1.45 times load voltage

NOTES:

To qualify the adjacent:
1. Load voltage is assumed to be the same in both cases.
2. Increased power factor has reduced the original load current, but additional load has brought the current back to its original value so that resistance and reactance drops are still the same.

Line reactance has a greater effect on supply voltage as load power factor decreases.

MOTOR PERFORMANCE CURVES (Compiled by Electric Journal)

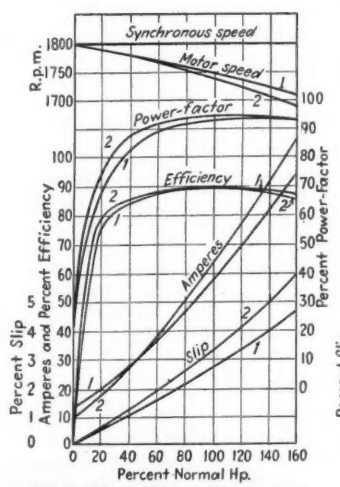


FIG 1.—Typical 3-phase, 220-volt, 1750-rpm, squirrel cage motor. 1—At 220 volts: pull-out torque = 360% full-load torque; starting torque = 178%. 2—At 198 volts: pull-out torque = 290%; starting torque = 148%.

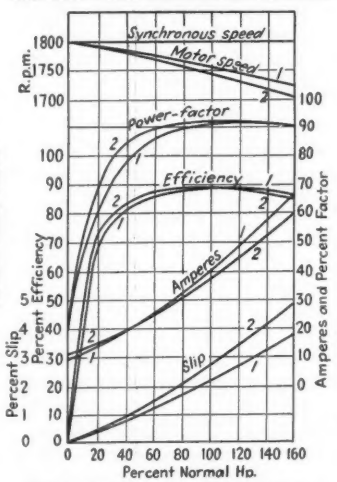


FIG. 2—Typical 3-phase, 220-volt, 1750 rpm. wound-rotor motor. 1—At 220 volts: pull-out torque = 320% full-load torque. 2—At 198 volts: pull-out torque = 250% full-load torque.

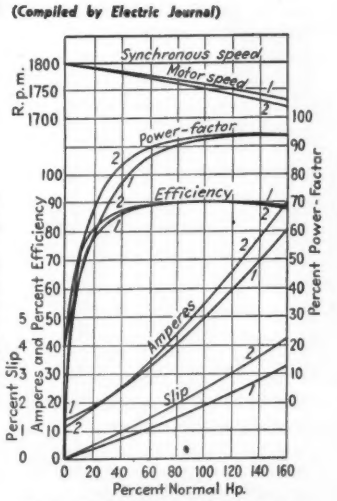


Fig. 3.—Typical 2-phase, 220-volt, 1750-rpm. squirrel cage motor. 1—At 220 volts: pull-out torque = 440% full-load torque; starting torque = 190%. 2—At 198 volts: pull-out torque = 350%; starting = 150%.

CORRECTIVE KVA. REQUIREMENTS

Original Power Factor	Final Power Factor	Corrective Kva. Required
65	70	149
70	75	138
75	80	132
80	85	130
85	90	136
90	95	155
95	100	329

NOTE: Corrective kva. in the above amounts would be required to raise the power factor of a 1000 kw. load from the original in Column 1 to the final in Column 2.

Under some conditions motor starting duty determines the motor horsepower required and indirectly may bring about low power factor by such a large motor being lightly loaded thereafter once the machine is running. The maintenance of ample voltage during the starting period would ensure full torque and might do away with some need for over-motoring. Another method might be to start the motor and then connect it to its load through a clutch.

Sometimes substituting a smaller motor for a larger one and equipping it with a flywheel to help carry the peaks will improve power factor. Another scheme would be to reallocate underloaded motors to jobs where they would serve at full load or slight overload. Where motor speed is not critical, a smaller motor of greater slip might successfully replace a larger motor.

Synchronous motors excel in some ways in power factor corrective work. Their output of leading kva. is controllable through field exciation and so should not bring about conditions of excessive voltage rise at periods of light load.

Synchronous motors are applied to constant-duty machines like on large air compressors and motor-generator sets, and are generally designed for full load operation at 80 percent leading power factor.

Attention should be given to the operation of synchronous machines to obtain maximum benefits. Where horsepower needs are less than rated, the motor might be operated with a strong field to increase its output of corrective kva. However, the field windings of synchronous machines are generally the part which would limit the output, not having been designed to successfully carry much more than their rated load.

For maximum benefit it may be necessary to check any meters originally supplied with such a synchronous motor outfit. Years of use may have left errors in their readings. In case meters are not available for checking the operation of such a set, one might well turn to the power company for assistance. As previously stated, utility companies are glad to help customers improve their power factors.

Single-phase motors have lower power factor than larger polyphase units, and where many are used deserve particular attention. It should be pointed out here that the capacitor motor is the nearest approach to the squirrel-cage machine in accomplishing the required motor starting phase displacement.

Capacitor-start capacitor-run motors have power factors of around 85 percent as compared to 75 percent for general purpose split-phase units, so are preferable from a power factor angle.

General

After power factor has been corrected to as high a value as is practicable by the various readjustments suggested, additional increases may be obtained by the application of the capacitor.

Capacitors have many advantages as power factor corrective equipment. They are easily installed, trouble-free, readily purchased as standard units and have practically no losses. They can be fitted into the industrial picture very neatly.

The point of connection of a capacitor to a system should be studied for best results. Plant growth might make desirable, or necessary, the transfer of a capacitor to a different feeder. Fortunately, capacitors are usually easy to move. It is usually better to locate the capacitor at the low power factor load for maximum benefit of reduced voltage drop and power loss.

Where capacitors are located at the load, the wiring system, transformers, switching equipment and generators are all relieved of just so much excess circulating current. And being connected at the load generally results in their disconnection when the load is shut down and the capacity no longer desirable. The disconnection of capacitors sometimes becomes necessary in order to avoid an undue rise in voltage.

The needless connection of motors, transformers and inductive apparatus to a system pulls down the power factor. Transformers which supply night lighting loads or equipment used infrequently should be disconnected on the high side when not in use, rather than simply switching off the load at the utilization devices.

Group operation of machines has advantages, including improved power factor. This method of providing driving power might be a solution in departments where lines are overloaded by excitation or circulating current of motors running at light load. By careful attention to diversity of loads in the grouping of machines and to actual power requirements, very low power factor might be overcome.

Of course, diversity of operation can be enforced as was the case recently when laboratory test motor-generator sets were interlocked with similar large sets within the plant. In this case, it was done to save demand charges, but at the same time excessive circulating excitation current was avoided.

High voltage increases the excitation current drawn by motors, and where many small motors are connected, this may be the cause of resulting poor power factor and motor overheating.

On the other hand, where capacitors are in use, it must be remembered that their kva. varies as the square of the voltage, which might offset the increase in excitation current of motors on higher than rated voltages.

Proper load scheduling of operations might help. For instance, a shop was fabricating by welding and later testing the completed assembly. Neither operation was continuous, and yet both were loads of very low power factor. In this case, it was simply a matter of planning to avoid low power factor by not scheduling these operations for the same day.

Analysis of a low power factor problem involves many factors. Generally lightly loaded motors cause most of the trouble. Good housekeeping can help by shutting down on disconnecting inductive equipment when not in use. Wiring systems should be arranged for low reactance. Transformers should be closely matched to the load, diversity considered. Full rated voltage should be maintained to avoid the tendency to over-motoring. Synchronous motors now operating should be checked for operation at a greater leading power factor. In spite of everything, certain of these bad conditions do exist in the vast majority of industrial and commercial establishments, and consequently power factors can be improved.

How an aviation assembly plant gets over 90 per cent power factor without corrective devices.

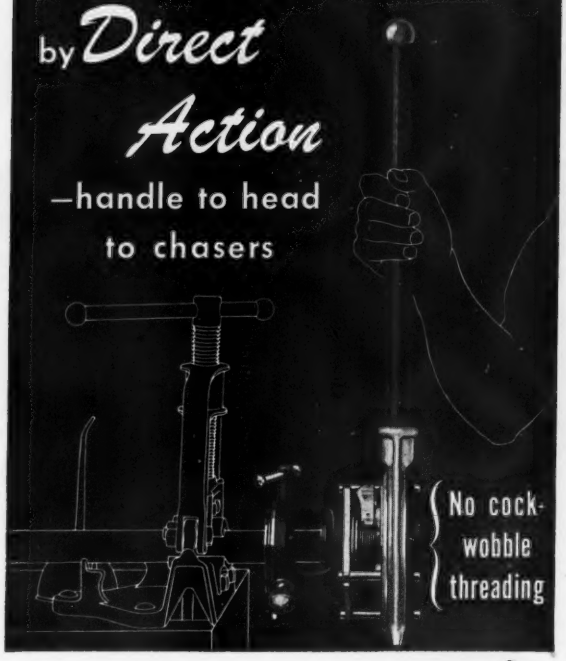
1. **Low voltage feeders are short. Low voltage power and light distribution transformers are near load centers.**
2. **Lighting is principally high power factor fluorescent.**
3. **Machines are not over-motored. Overall load is near to motor rating.**
4. **All electric drives are individual.**
5. **Press loads float on flywheels.**
6. **High frequency and capacitor type fractional hp. motors were specified because of desired operating characteristics in production.**
7. **Majority welders stored energy type.**
8. **Single phase welders mechanically interlocked so that peaks cannot be reached simultaneously.**

UMI

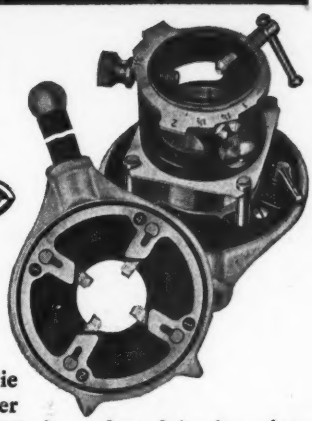
Smooth Easy Threading

by *Direct Action*

—handle to head to chasers



Floating Posts Carry No Load in this RIDGID Poster Threader



This RIDGID No. 1R die stock gives you faster easier threading of 1″ to 2″ pipe and conduit—its action is direct, in a straight line from handle to head to chasers. No chance for cocking or wobbling, you use less muscle, you cut smoother threads. Posts carry no load, merely taper the threads, and they're separately replaceable. Almost automatic foolproof workholders set to size instantly, speed the work—no bushings to fool with. Alloy or high-speed steel chaser dies. A rugged steel and malleable tool—yours at a popular price. Ask for a RIDGID No. 1R at your Supply House.

This stops waste of priceless time

RIDGID wrench housing is *Guaranteed* against break-down and time-out for repairs

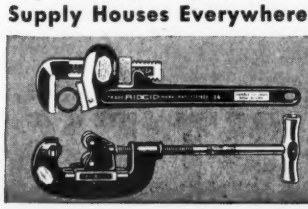
It's no startling news to you that one tool that stays on the job is worth two that fall out for repairs, but it's a critically important fact these days. That RIDGID guarantee makes this wrench doubly valuable now. For the housing, crucial part of any pipe wrench, simply won't break or warp. Adjusting nut, out in the open, *always* spins easily to pipe size. Non-slip jaws that won't lock on pipe, handy pipe scale on hookjaw, powerful comfort-grip I-beam handle. RIDGID *does* save you time, effort—and the cost of "spares." Ask your Supply House for this favorite of millions of users.

Buy RIDGID Pipe Tools at Supply Houses Everywhere

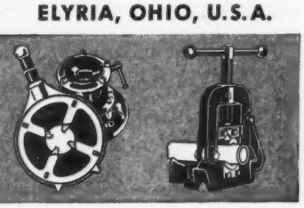
RIDGID

★ PIPE TOOLS ★

THE RIDGE TOOL COMPANY
ELYRIA, OHIO, U.S.A.



Fast-Working Tools for War . . . and the Busy Peace That's Coming



UMI

U. S. Rubber Laytex Army Assault Wire requires only one-fifth the shipping space of ordinary communication wire ...releases four times the room for men, material, food for overseas.

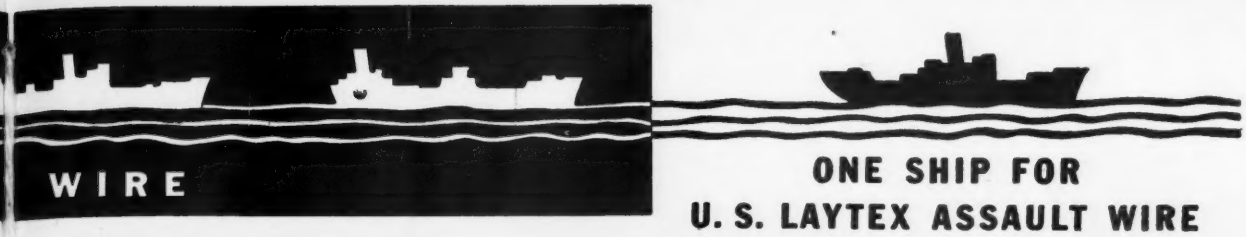
Light, strong and plenty tough, Laytex is the most flexible of all insulation for electrical conductors. It is waterproof, resists wide-range temperature changes...and will not shatter under concussion. Conductors are perfectly centered...because the unique Laytex Process applies the purified insulation in liquid form.

Laytex Assault Wire meets every basic requirement of the Armed Forces. It weighs less than 30 pounds per mile, twisted pair; has a breaking strength of 50 pounds per conductor; a talking distance of five miles. Millions of feet of Laytex Assault Wire are now on active duty wherever American Armies are in the field.

1230 Sixth Avenue

UNITED STATES

UMI



ONE SHIP FOR
U. S. LAYTEX ASSAULT WIRE

SPACE REQUIRED FOR ASSAULT WIRE

US Laytex
REG. U. S. PAT. OFF

ASSAULT WIRE MEETS EVERY BASIC MILITARY REQUIREMENT

Rockefeller Center • New York

RUBBER COMPANY

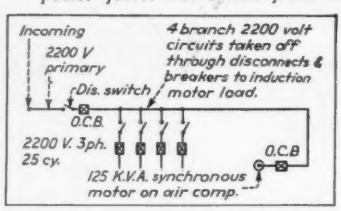
UMI

Reader's QUIZ

QUESTIONS from readers on problems of industrial equipment, installation, maintenance and repair. Answered by electrical maintenance engineers and industrial electrical contractors out of their experience. For every question and every answer published, we pay $5.00.

POWER FACTOR CORRECTION

QUESTION 93. Do any of the branch circuits in diagram receive power factor correction from the


Incoming
2200 V primary
Dis. switch
O.C.B.
2200 V. 3ph. 25 cy.
4 branch 2200 volt circuits taken off through disconnects & breakers to induction motor load.
O.C.B
125 K.V.A. synchronous motor on air comp.

synchronous motor? If none, how far on the line would correction exist?—W.R.T.

A. TO QUESTION 93. The synchronous motor in the diagram accompanying this question does not change or affect the power factor in any of the branch circuits shown in that diagram.

Power factor correction occurs only in the circuit and apparatus through which current or power flows to and from the power factor corrective apparatus. In other words, referring to the diagram, the power factor of the feeder circuit to the synchronous motor and of the incoming line will be improved. Beyond the scope of the diagram, power factor improvement could be traced to the electrical generating station. It will occur in the medium voltage distribution system circuit serving this plant, in the transformers feeding that circuit, and in the voltage regulators in that circuit: in the substation transformers and other apparatus through which electrical energy feeds to the plant, and in the high voltage transmission lines between the substation and the electrical generating station.

If W.R.T.'s last sentence was intended to ask how far on the line the power factor connection provided by the synchronous motor will result in leading power factor, the information given is insufficient to permit a definite answer. However, this may be calculated in the following manner if the necessary information can be obtained: Assuming the 125 kva. synchronous motor is rated 0.8 power factor leading at full load and rated voltage, when it operates under these conditions it will draw 100 kw. from the power system and, at the same time, deliver 75 kvar. leading to the power system. To determine at what branch circuit connection the feeder circuit characteristics will change from leading to lagging power factor it is necessary to subtract the kvar. lagging drawn by each branch circuit from the 75 kvar. leading delivered by the motor, starting with the branch circuit closest to the synchronous motor. So long as there is a remainder after the kvar. lagging of each branch circuit is subtracted, the power factor of the feeder is leading at that branch circuit tap. A similar method of obtaining this information is to add the kvar. lagging of each branch circuit, starting with the one nearest the synchronous motor. So long as the sum does not exceed the kvar. leading of the power factor corrective apparatus—assumed as 75 kvar. in this case—the power factor of the feeder circuit is leading. When the sum of the kvar. lagging exceeds the kvar. leading delivered to the system by the power factor corrective apparatus, the power factor at that point, and from there toward the electrical generating station, is lagging. It is evident that the kva or kw. and power factor or that the kvar. of each branch circuit must be known to solve this question. That information may be determined by test, if the necessary instruments or meters are available; or it may be obtained from the manufacturers' test curves or data applying to the apparatus connected to each branch circuit.—P.O.L.

A. TO QUESTION 93. The "dirty work" caused by each induction motor extends all the way from the motor terminals back to the generating equipment and may cause possible overloading of the feeder lines and buses. Theoretically the ideal place to put the power factor corrective apparatus is to divide it up and place a portion at the terminals of each induction motor. This would relieve each individual motor feeder line leading to the main bus, depending on the amount of reactive component used. The least beneficial place to put it would be at the terminals of the generator. This would relieve the generator windings only and would be of no benefit of the feeder copper. Using one synchronous motor, it is obviously impossible to divide it in four parts, using one part for each induction motor circuit, but if it so happens that one of the four induction motor circuits is a lot larger than the other three, the synchronous motor might be used on this circuit and be of some benefit here, but it would not be of any more help to the other three feeder circuits than it is now as shown in WRT's diagram.

If the four induction motor feeder circuits are overloaded, it would be worthwhile to check the actual load being carried by the induction motors. If a certain motor requires 20 kva. reactive component for excitation it makes no difference whether the motor is carrying load and a half, full load, half load or even no load at all, the feeder copper has got to support this 20 kva. load in addition to whatever kw. is caused by the mechanical driven load to which the motor is connected. Assuming the motor in question is running at ½ load, a motor half this size and loaded up to full capacity would (other things being equal) cut down the 20 kva. useless load to 10 kva. Furthermore, if the motor is a 40 deg. C. open continuous rated machine, it will carry 1.15 times its rated load with only possibly slight differences in efficiency and power factor from those at rated load. This service factor of 115 percent does not ordinarily apply to totally enclosed or splash-proof motors however. In these days of conserving strategic materials, it is worthwhile to take some recognition of this service factor whenever possible.—R.F.E.

A. TO QUESTION 93. None of the four induction motor branch circuits will receive power factor correction from the synchronous motor.

UMI

Nevertheless, voltage conditions at the load center will be improved. The economy of using a synchronous motor from this standpoint depends upon (1) existing voltage conditions, (2) feeder voltage regulation furnished by the utility, and (3) high power factor rates offered.

In theory, the full power factor correction of the synchronous motor will extend back through the line as far as the generator. The magnitude of the leading component of the current will diminish at each point of tapping off an inductive load. This value can be solved step by step, beginning at the synchronous motor and working toward the main circuit breaker.

The power factor of the combination also is altered by the feeder voltage drops to the synchronous motor and between each branch to an induction motor. Ordinarily, however, this consideration is of little practical importance if the system is well designed and the distances small.

The following optional illustration is based upon arbitrary assumptions of conditions existing in each branch circuit. A similar method may be used to suit actual conditions. Field tests should be taken so as to include the feeder voltage drop.

The kilowatts load may be determined by a wattmeter test. The total kva. load is found by an ammeter-voltmeter test. (If the load is not balanced, the average ammeter reading at any point will suffice, if the difference is reasonable). The reactive kva. is determined by computation. (The square of the kilowatts plus the square of the reactive kva. equals the square of total kva.) The induction motor circuit numbers begin with the branch nearest the synchronous motor.

Circuit	Kilowatts Load	Total kva.	Reactive kva.
Synchronous Motor	100	125	74.8 (lead)
Induction Motor No. 1.....	50	56	25.4 (lag)
Induction Motor No. 2.....	25	31	18.3 (lag)
Induction Motor No. 3.....	75	87	31.1 (lag)
Induction Motor No. 4.....	100	105	32.4 (lag)
Total	350	...	32.4 (lag)

The reactive kva. is totaled by considering the lagging as positive and the leading as negative.

The total kva. is found by computing by means of the square rule. It equals 351 kva.

This gives a power factor for the system of 99.8 percent lagging.

It will be noted that the leading power factor is offset by the lagging power factor of the first three induction motors.

Electric utilities sometimes base their power factor discounts upon the readings of two watt hour meters. One is connected to read kilowatt hours in the usual manner. The other is connected to integrate the reactive kilowatt hours.

PALMGREN

RAPID CABLE AND TERMINAL CONNECTORS

Save Time—Labor—Expense

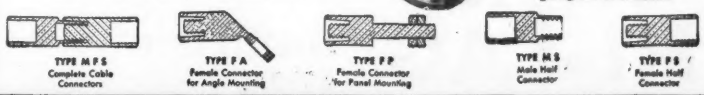
Speed up production—end needless delays! It takes only 3 *seconds* to HOOK-UP—LENGTHEN—REPLACE or SHORTEN Cables with PALMGREN Cable Connectors. Construction assures positive contacts, highest conductivity with secure locking of connectors. No parts exposed—insurance against shorting and fire hazards. Connectors will handle 1, 1/0, 2/0, 3/0 and 4/0 cables.

PALMGREN Engineers will gladly design new types of connectors to meet your industrial need. Having pioneered this field, we developed many types for use in Welding—Mining—Supply Lines—Ships—Railways, etc., wherever conductor cables are used. *Write us today!*

Write for Circular AC-5 describing complete line, also price list

Just a Twist of the Wrist

Simply grasp the two halves and turn in opposite directions. A ¼ turn locks or unlocks. No tools required—no bolts, nuts, washers or gadgets to loosen.



CHICAGO TOOL AND ENGINEERING CO.

Manufacturers of PALMGREN PRODUCTS for Over 25 Years

8347 SOUTH CHICAGO AVE. CHICAGO, ILLINOIS

HERE'S A WAY YOU CAN CONSERVE "CRITICAL" STEEL!

Briegel fittings are made with 25% less steel than any other fittings on the market. Approved specifically for use in concrete and interior jobs.

Briegel Method Tool Co.,
Galva, Illinois

DISTRIBUTED BY

The M. B. Austin Co.
Chicago, Ill.

Clayton Mark & Co.
Evanston, Ill.

Clifton Conduit Co.
Jersey City, N. J.

General Electric Co.
Bridgeport, Conn.

The Steelduct Co.
Youngstown, Ohio

Enameled Metals
Pittsburgh, Pa.

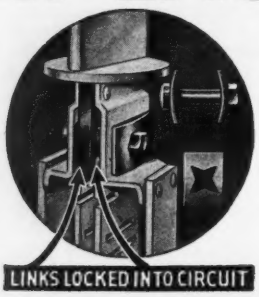
National Enameling & Mfg. Co.
Pittsburgh, Pa.

Triangle Conduit & Cable Co.
New Brunswick, N. J.

BRIEGEL METHOD TOOL CO., Galva, Ill.

UMI

WARE HI-LAG



NON-HEATING CONTACTS

Keep Motors Humming

- End Over-Heating
- Stop needless fuse blowing
- Time-Lag 2 to 5 Times Normal Current
- Certified to Comply—Federal Specification W F 803a-Type II

APPROVED BY UNDERWRITERS

WARE BROTHERS

4410 W. Lake St. Chicago, Ill.

WARE Renewable HI-LAG FUSES

Reader's QUIZ

[FROM PAGE 71]

This method does not give the true power factor of the system at any time. It is merely a measure of an average power factor over the billing period.

If this method is used in the billing, the tabulation above should continue two additional columns: kilowatt-hours and reactive kilowatt hours. These are derived by multiplying kilowatts load and reactive kva. by the hours use in the billing period. The studies and conclusions are made in the same way as illustrated.

If all motors operate for the same periods, this refinement is unnecessary. If a time element does enter, it would be interesting to note the difference in the system power factor as found by the two methods.—L.E.B.

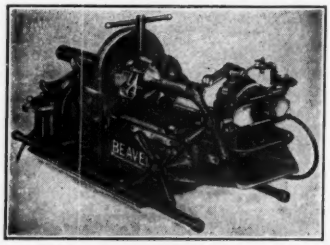
SQUIRREL CAGE MOTORS

QUESTION 94. Our motors are rated to operate from 440-volt, 3-phase, 60 cycle power. We have 14½-hp. squirrel cage motors driving a flight conveyor system which we believe could operate safely at a considerably higher speed to carry more material. These motors never draw more than 80 percent of rated full load current. It is proposed to operate the system on higher frequency power derived from two available 40 hp., 1760 rpm. slip ring motors with 265-volt, 3-phase rotors. What ratio of pulley diameters should we use on the two motors to connect them with V-belts, and if a transformer is needed what will be the power and voltage rating required?—G.I.S.

A. TO QUESTION 94. I don't believe increasing the frequency of the power supply to the motors is a practical solution for your problem. While it is true that an increase in frequency will increase the motor speed it will also lower the motor torque. For example—increasing the frequency five percent above normal will increase the speed five percent and lower the torque about eight percent. I would investigate the possibility of increasing the conveyor speed by changing the drive connection ratio of the motors and the conveyors.

As the question didn't mention the frequency you contemplated using, it

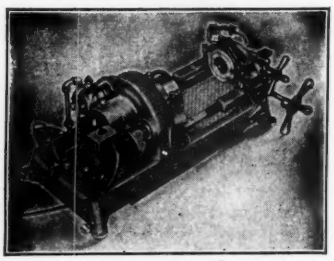
The A-B-C of . . . Pipe and Bolt Machines!



Beaver Model-A

A high-speed heavy-duty deluxe Pipe and Bolt Machine. Range ⅛ to 2-inch-up to 12-inch with geared tools and drive shaft. Bolts, ¼ to 2-inch. Wt. 415 lbs.

Write for Bulletin A



Beaver Model-B

A light-weight utility Pipe and Bolt Machine combining many features of Model-A with the easy portability of Model-C. Range ⅛ to 2-inch up to 8-inch with drive shaft and geared tools. Bolts up to 1½-inch. Weight 280 lbs.

Write for Bulletin B

Beaver Model-C

A STURDY LITTLE POWER UNIT Converts hand pipe tools into power tools from ¼ to 8-inch. Threads 8-inch in 6 minutes. Threads bolts up to 1½-inch. Two men can work at the same time without interference. Weight 150 lbs.

Write for Bulletin C

Write for new Tool and Machine Catalogue—Just off the press

BEAVER PIPE TOOLS

542 Deen Ave., Warren, O.

wouldn't be possible to figure the rotor speed of the induction converter. As an example however, your slip-ring motor is a four pole motor, therefore the 60 cycle magnetic field will travel around the stator at a speed of 1800 r.p.m. If you were going to convert from 60 cycle to 70 cycle frequency, you would drive the rotor at a speed of 300 r.p.m. in a direction opposite to the magnetic field in the stator. To increase the frequency five percent, or to 63 cycles, you would drive the rotor at a speed of 90 r.p.m. opposite to the magnetic field in the stator. The above examples were figured from the following equation:

$$\frac{1800 + R}{1800} \times 60 = \text{Frequency}$$

In order to figure the voltage, it is necessary to know the speed of the rotor, which in turn depends upon the frequency you are converting to.

I would consult the manufacturer of the slip-ring motor for ratings of the motor as an induction converter at the frequency you desire it to supply.—V.M.

A. TO QUESTION 94. The power requirements for this flight conveyor system are assumed to vary directly with the speed. Therefore a 25 percent increase in speed should load the motors to 100 percent of rating. Present day motors have a service factor of 1.15 so these motors could carry some overload if necessary. Also, if the motor speed were increased 25 percent the horsepower output would be 125 percent of the 60 cycle rating or $\frac{5}{8}$ hp. A 25 percent increase in frequency and voltage would be necessary.

I would suggest the following: Drive the frequency changer at 450 r.p.m. Applying 440-volts, 60 cycles to the stator should deliver approximately 330 volts at 75 cycles from the collector rings with proper rotation of the frequency changer. (The wrong rotation will deliver approximately 159 volts at 45 cycles.) To bring the voltage up to 550 at 75 cycles use a three coil autotransformer from a 440 volt, 15 hp. 60 cycle compensator. Feed the output of the frequency changer (330 volts) into the 60 percent taps and you will get 550 volts from the line leads to feed the motors on the conveyor system.

If the conveyor motors are controlled by magnetic switches, no changes will be necessary in them because the voltage increase will take care of the increase in frequency applied to the operating coils. Practically all switches for 440 volts are made with 600 volt spacing of main contacts.

As only 25 percent of the necessary power is supplied mechanically by the frequency changer (the balance is supplied by transformer action within the frequency changer) a 5 hp. motor should

JOHNSON BRONZE SLEEVE TYPE BEARINGS

How to make Good Motors BETTER

NEW Catalogue

Lists and describes the most complete stock bearing service available. Write for your free copy.

It makes little difference whether you are buying, building or repairing motors, JOHNSON BRONZE can help you. In new equipment we can help you design the *type* of bearing that will guarantee the most efficient operation. For replacements, we offer you the largest range of sizes and types in bearings available. In order to get the most from your motors —consult with JOHNSON BRONZE. Let us help you make good motors *BETTER.*

JOHNSON BRONZE

Sleeve BEARING HEADQUARTERS

490 S. MILL STREET · NEW CASTLE, PA.

● *Temperature is controlled by the careful regulating of kilowatt input.*

Adequate Facilities

Superior Electrographitic Brushes, after the usual baking with gas or oil heat, are heat-treated in this electric furnace at temperatures ranging from 4000 to 5000 degrees.

Only an electric furnace in which the carbon plate itself is the heating element can produce temperatures high enough to give the required characteristics.

Graphitizing accomplishes the four following purposes:

1. It completes the carbonization of the original binder, thereby insuring long brush life.
2. It purifies the product by volatilizing impurities, as oxides of silica and iron.
3. It graphitizes the carbon left from the binder and thus insures proper lubrication.
4. It adds to the mechanical strength of the brush grades and enables them to withstand severe operating conditions.

We shall be glad to talk with you about your exact requirements. Perhaps our Catalog No. 8 on Industrial Brushes or Catalog No. 7 on Mining Equipment Brushes will help.

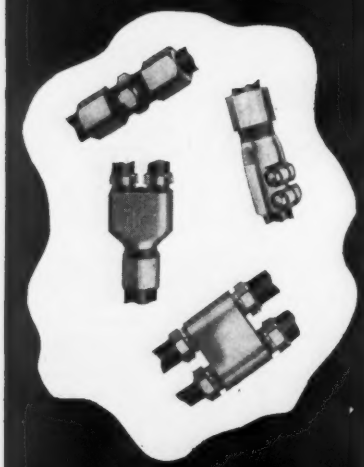
Your letterhead request will bring you these two Superior Catalogs.

SUPERIOR CARBON PRODUCTS, INC.

"Since 1919" SUPERIOR CARBON BRUSHES

9113 George Ave.
CLEVELAND
OHIO

"GORILLA GRIP"
MECHANICAL CONNECTORS



National Electric "Gorilla Grip" mechanical connectors are considered the "Precision Job" because of the obvious good engineering, machining, and mechanical features.

Stock sets made to suit your requirements. Electrical maintenance men then have on hand the correct size connector for any installation.

Write for booklet, "Mechanical Principles of Gorilla Grip Electrical Connectors" as illustrated below.

National Electric
PRODUCTS CORPORATION
Pittsburgh, Pa.

Reader's QUIZ

[FROM PAGE 73]

take care of the driving requirements for it.—L.H.

A. TO QUESTION 94. I suggest that you use a mechanical system for your purpose instead of an electrical system.

With an electrical system you will have to use 75 cycles at 550 volts, you will have to bear the cost of a 7 kw. transformer, you will get the power factor penalty of a badly underloaded 40 hp. motor, and in addition to all this, consider your share in our war effort and don't tie up two 40 hp. slip ring motors for the duration. If you have no use for them yourself, just sell them.

To increase speed change pulleys.—H.S.

Can You ANSWER these QUESTIONS?

QUESTION Y3—In order not to halt our power supply, we used a line phasing tester before inter-connecting two circuits of 4160 volts four wire three phase. The new circuit came direct from the main power plant, and the old circuit, which came from a substation served from the main power plant was to be removed. Carefully phasing out each hot leg we made the interconnections, which tied both circuits in parallel. A few minutes after making our last hot line connections the insulation started to heat up. What caused this?—W.H.L.

QUESTION Z3—In my place we operate at day time load with a power factor running anywhere from unity to 75 or 80 percent and we have a motor generator set delivering d.c. to the plant motors and this unit is in turn driven by a synchronous motor. This same motor gets its d.c. for excitation from the busbars fed by its generator and starts as an induction motor. Also we have a synchronous motor operating a refrigerating unit.

However at night and late in the evenings when the load falls off the power factor swings over to leading, sometimes as much as it was lagging in the day time loads. Should this leading power factor be corrected? And how does it affect the power bill?—R.G.S.

PLEASE SEND IN YOUR ANSWER BY JUNE 1

FIBERGLAS
ELECTRICAL INSULATION
gives you these
4 ADVANTAGES
for those
really "HOT JOBS"

- High Heat Resistance
- Extreme MOISTURE Resistance
- Resists Corrosive Vapors
- Great Mechanical STRENGTH

Fiberglas is carried in all standard forms—tape, sleeving, tying cord, and cloth. Also in such combinations as varnished Fiberglas cloth, mica and Fiberglas, Fiberglas laminated bakelite. See pages 14 and 15 of the IWI Blue Catalog. Write today.

INSULATION AND WIRES SERVICE

Distributed by:
INSULATION and WIRES, Inc.
2127 Pine Street, St. Louis, Missouri
289 Simpson Street, N. W., Atlanta, Georgia
30 Trowbridge Avenue, Detroit, Michigan
181 Portland Street, Cambridge, Massachusetts

Complete the Job with TRICO

FUSE PULLERS

Contribute to the war effort by protecting man-power. Equip every fuse cabinet with TRICO FUSE PULLERS. It's cheap insurance against unnecessary accidents.

WRITE FOR BULLETIN #5

KLIPLOKS
LOCK LIKE A VISE

Make every job complete by installing TRICO KLIPLOKS and save critical materials. Poor contact causes high resistance resulting in unnecessary shutdowns—destruction of fuses and clips—premature fuse blowings—wasted current—unnecessary repairs.

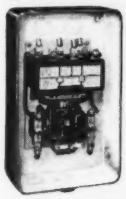
WRITE FOR BULLETIN #6

TRICO FUSE MFG. CO., Milwaukee, Wis.
In Canada: IRVING SMITH LIMITED, Montreal

UMI

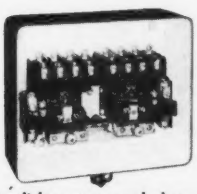
These 3 Types of trouble-free starters will solve most of your motor control problems

BULLETIN 709 ACROSS-THE-LINE STARTER



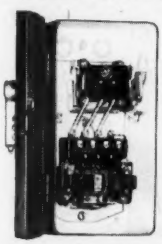
The simplest starter for alternating-current motors . . . never needs any maintenance. Has only one moving part. No pins, pivots, or hinges to stick. No flexible jumpers to break. Silver alloy, double break contacts never need cleaning or filing. This is the starter you install and can forget. It's good for millions of trouble-free operations. For complete details, write today for Bulletin 709.

BULLETIN 705 REVERSING SWITCH



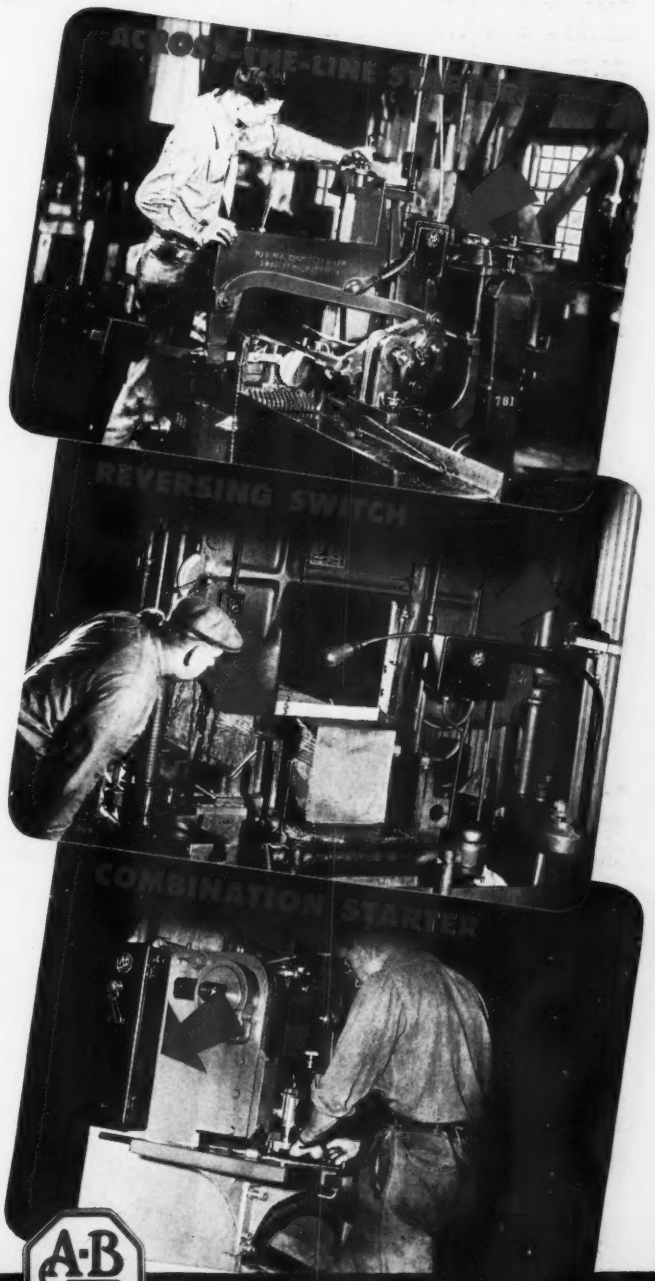
Two Bulletin 709 starters, mechanically interlocked so both contactors cannot be closed at the same time, form an Allen-Bradley automatic reversing switch. They have the same simple construction and trouble-free life. These switches open and close instantaneously without perceptible variation in operating time. Write today for Bulletin 705 for details.

BULLETIN 712 COMBINATION STARTER



These combination starters, consisting of a solenoid starter and disconnect unit in one cabinet, reduce installation time, save space, save critical materials, make a neater installation, and provide greater safety. Both units have patented double break, silver alloy contacts assuring freedom from maintenance. Available in enclosures for every class of service. Write today for Bulletin 712.

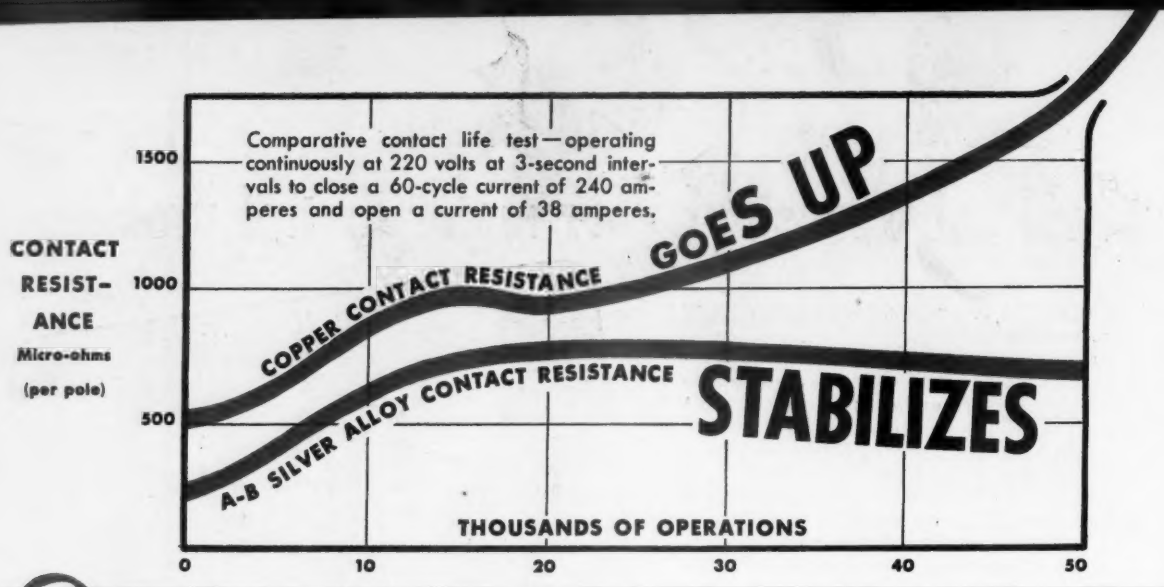
Bulletin 800 Types 2SA and 3SA are two popular A-B push button stations. More than 800 varieties of push buttons are available to meet any operating requirement. They are neat, compact, rugged, and trouble-free, too.



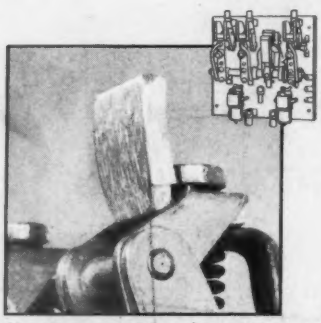
A-B Quality

ALLEN-BRADLEY

SOLENOID MOTOR CONTROLS FOR ALL INDUSTRIES



That's Why A-B SILVER ALLOY CONTACTS OUT-PERFORM COPPER CONTACTS



New copper contact on clapper type switch at start of 50,000 operations.

Same contact after test. Badly pitted and oxidized—must be replaced.

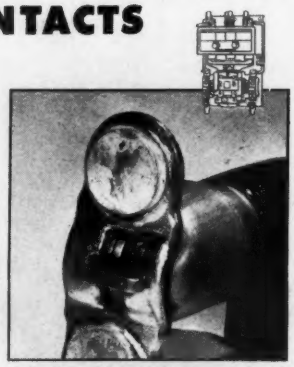
There's a big difference between copper and silver alloy contacts. It shows up quickly . . . in less than 50,000 operations . . . as revealed in the above test.

Copper contacts become coated with a high-resistance oxide that causes them to overheat. Heat . . . then more oxide . . . then more resistance . . . still more oxide . . . still more resistance . . . then failure and shutdown for replacement.

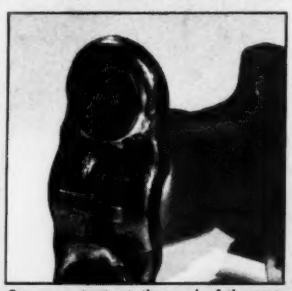
A-B silver alloy contacts also become coated with oxide . . . but silver oxide is just as good a conductor as the original metal. There is no heating . . . no increase in resistance . . . no matter how long A-B silver alloy contacts remain closed, they never fail. They never need filing, cleaning, or dressing. They are completely maintenance-free.

Every test . . . in laboratory or in service . . . verifies the superior performance of silver alloy contacts. Specify Allen-Bradley solenoid starters—all are equipped with patented A-B silver alloy contacts.

ALLEN-BRADLEY COMPANY
1316 S. Second St., Milwaukee, Wis.



A-B silver alloy contact on solenoid starter at start of 50,000 operations.



Same contact at the end of the test still in perfect operating condition.

ALLEN-BRADLEY

SOLENOID MOTOR CONTROL

QUALITY

UMI

Questions ON THE Code

Answered by
F. N. M. SQUIRES
Chief Inspector New York Board of Fire Underwriters

Splices in Sealing Fitting—Prohibited

Q. *"Will you explain the reason why, in Rule 5014 B (Sealing) —Splices shall not be made in fittings intended only for sealing purposes nor shall other fittings in which splices are made be filled with compound?"—D.J.B.*

A. Of course sealing fittings are not of sufficient size to contain splices, which is the reason for the first part of the rule quoted.

The requirement in the latter part of the sentence has been violated many times as a make shift arrangement where a formerly non-hazardous location has changed to a hazardous one through change of occupancy or change of kind of work being done.

Of course filling a pressed steel box with sealing compound, is, a long way off from making such a box into an explosion-proof one, nor does filling an explosion-proof box with compound, make an 'honest-to-goodness' explosion proof conduit job.

Metallic Boxes

Q. *"We are doing a job on some temporary war buildings. The project manager has requested that we ground metallic boxes in the kitchens and bathrooms as required by the N.E.C. sections 2556 and 4128 of the code.*

"We have installed metallic boxes in both locations and the job is wired in non-metallic sheathed cable. The covering on the walls is plywood. There is no lath used on the job. The outlets are not within 2 ft. 6 in. of any metal piping. The fixture is porcelain with a bakelite knob that screws on to the ⅛ nipple holding the fixture to the outlet. Receptacles and switches have bakelite plates.

"May we have a ruling on this?"—L.R.

A. The grounding of outlet and receptacle boxes which are "non-current carrying metal parts of fixed equipment" is required if the equipment is supplied by means of a metal clad wiring system or if the boxes are in contact with metal or metal lath. This requirement is found in section 2542 of the Code.

Therefore, if the boxes are on non-metallic sheathed cable and not in contact with metal or metal lath they need not be grounded. Of course, we assume that all of the wires in the non-metallic sheathed cable are fully insulated inasmuch as Interim Amendment No. 43, which permits the use of a conductor without individual insulation to be used for the grounded conductor in non-metallic sheathed cable, requires that non-metallic outlet boxes be used with that type of cable.

For the grounding of the fixtures referred to, we consult Section 4105 and also Official Interpretation No. 217, which concerns Section 4105. Here we find that exposed metal fixtures supplied by a metal clad system must be grounded and, of course, if within range of plumbing fixtures must be grounded, but if not of metal and having no metal parts exposed, need not be grounded especially if supplied by non-metallic sheathed cable.

Therefore, the boxes, fixtures, switch and receptacle face plates presenting no exposed metal to contact as described in the question need not be grounded.

Slow Burning Insulation vs Breakdown Test

Q. *"I recently made a test on some slow burning insulated wires using four No. 2 wires in 1¼-inch conduit and found that it required 3500 volts to break down the insulation. Also on four-300,000 C.M. S.B. wires in 2½-in. conduit it ran to 4700 volts before breakdown. If this type of insulation will withstand such high voltage, why cannot it be used for general use on 220 volts in conduit?"—L.M.N.*

A. Undoubtedly the above test was run under dry condition and the high voltages required for breakdown were to be expected. But had there been a little moisture present in the insulation, the results might have been very different. The Code rules do not pro-

***SUPERVISED STUDY** of estimating problems proceeds under the watchful eyes of Ralph H. Decker, instructor, at the final sessions of the Cook County Electrical Contractors Association estimating course in Chicago.*

UMI

FLUORESCENT FIXTURES FOR WAR INDUSTRIES

Meeting Latest W.P.B. Requirements*. . .

The entirely new OAMCO War Production Fluorescent line is designed and built for use in industrial plants doing essential war work that requires High Intensity Illumination. These new OAMCO units incorporate a number of improvements in design and construction that simplify installation, facilitate continuous row mounting, add to ballast life because of cooler operation and lessen wiring time. The reflectors are made of a rigid non-metallic material and have a baked double coat of glossy white chip-proof enamel that gives them a tough hard surface with a reflection factor of 85%. These fixtures are furnished in Double 40, Triple 40 and Double 100 units. Write today for complete facts on this new OAMCO line!

★ In compliance with the Amendment to Limitation Order L-78 40 Watt Units contain less than 3 pounds of steel per fixture. 100 Watt Units contain less than 4 pounds of steel per fixture.

RIGHT LIGHT SINCE 1902

OVERBAGH & AYRES MFG. CO.

MEMBER OF THE R L M STANDARDS INSTITUTE

411 SOUTH CLINTON STREET • CHICAGO

Questions on the Code

[FROM PAGE 77]

hibit the use of wires with slow burning insulation in conduit, although for many years many authorities have believed it taboo. A few Codes back, the rules required the use of rubber covered wires except that in permanently dry locations varnished cloth (VC) insulated wires could be used and where the temperature exceeded 120° F. asbestos or slow burning wire could be used. (Rule 503L, 1933)

While the rules now fail to guide us as to what insulations may or may not be used in conduit, we do know that asbestos insulation will soak up moisture like a sponge and that slow burning insulation is only a little better and undoubtedly will not stand up long where any moisture is present. So these should not be used except in permanently dry locations where the heat is so excessive that all moisture will be driven off.

Sealing in Hazardous Location

Q. *"Will you kindly obtain an interpretation of N.E.C. 5014b which states 'all conduit shall be sealed off in an approved manner where conduit terminates in an enclosure—as at motor terminals—'.*

"Since the motor must be explosion proof to be located in this area, and must therefore have a seal between the terminal box and the interior, this ruling can only apply to the feeder conduit, yet A. L. Abbott in his National Electrical Code Handbook says (pp. 1, page 371) 'Thus an explosion proof motor is made with the leads sealed when they pass from the terminal housing to the interior of the motor and no other seal is needed where the conduit terminates at the motor.'

"It would appear from Mr. Abbott's interpretation that 5014b in this instance was referring to motor construction and not to conduit installation.

"What is your opinion?"—G.D.S.

A. It is this writer's opinion that the manufacturer of a fitting, such as a junction or motor terminal box or of a device, such as a motor, provides a seal between a compartment in which sparking may occur, and the wiring conduit, no further seal is necessary at the end of the conduit. Note the parenthetical clause in the second sentence of paragraph 5014b which makes the requirement mean that where

UMI

YOU CAN STILL PROTECT

Industrial Wiring WITH STEEL

W.P.B. Limitation Order L-225 permits the use of electrical metallic tubing, sizes ⅜" to 2", to protect wires and cables (1) from mechanical injury in the wiring to machinery or production equipment; (2) embedded in concrete or masonry walls; (3) in elevator hoistways; or (4) in damp or wet locations as defined in Article 100 of the National Electrical Code.

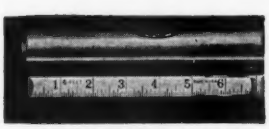
Industrial wiring is vitally important. It carries the energy for war production—so give it the protection against the hazard of interrupted service which only a raceway of steel affords. Enclose it in Republic "Inch-Marked" ELECTRUNITE STEELTUBES.

STEELTUBES is dual protection for both wiring and personnel. It provides steel's protection against mechanical injury. The automatic grounding protects personnel against stray currents.

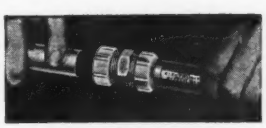
This electrical metallic tubing is tough and strong—light in weight and exceptionally easy to handle—easy to cut and bend—easy to wire—and because there are no threads, the wall is uniformly strong, even at joints. In addition to saving steel, you save tools because STEELTUBES connections require no stocks, no dies. Every length is marked off in feet and inches, making work easier and more accurate, preventing waste of material.

Couplings and connectors are all you need to adapt your present stock of threaded fittings and accessories for use with ELECTRUNITE STEELTUBES E.M.T. Use it on your next job. See your ELECTRUNITE Distributor for details.

REPUBLIC STEEL CORPORATION
Steel and Tubes Division
Sales Offices • Cleveland, Ohio
GENERAL OFFICES • • CLEVELAND, OHIO
Berger Manufacturing Division • Culvert Division
Niles Steel Products Division • Union Drawn Steel Division
Truscon Steel Company
Export Department: Chrysler Building, New York, New York

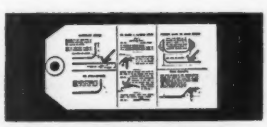


Every length "inch-marked" —just like a foot-rule.



No threads to cut— two simple fittings do the job.

Makes standard radius bends —easily—accurately—quickly.



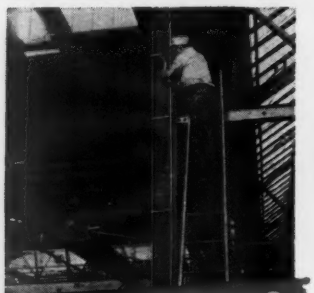
Complete bending instructions with every shipment.

Republic "INCH-MARKED"
ELECTRUNITE Steeltubes
Reg. U. S. Pat. Off.

ELECTRICAL METALLIC TUBING MARKED WITH A CONTINUOUS FOOT-RULE!

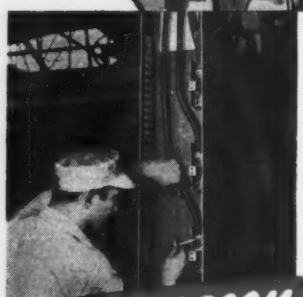
HOW TO DO 4 HOURS WORK IN 3

BullDog Narrow Column Circuit Breaker Panels—a Quick Windup to Wiring Jobs



1-ONE MAN JOB

Light, compact pieces—no heavy or complicated parts that take more than one man's time to install.

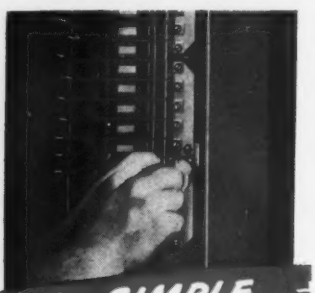


2-ELBOW ROOM

Wireman not slowed by having to work in narrow "side" gutters as cables are pulled and connected.

3-CLEAR VIEW

Work is faster, surer, as branch circuit wires are led to retainers — no groping or guesswork.



4-SIMPLE

Major wiring job done in an empty cabinet — panel is set and connections made to main cables.

5-NO SOLDER

Branch wires are readily inserted and tightened in the Solderless Wire Grips.

Now is the time when plants *must* cut every corner, to save precious maintenance time. BullDog's Narrow Column Panels meet industry's wartime need for speed of installation and ease of upkeep. Write for complete bulletin No. 426, covering various types of BullDog time and money-saving equipment.

MANUFACTURERS OF Vacu-Break Safety Switches, SafToFuse Panelboards, Circuit Master Breakers, Switchboards, Bus Duct Systems—FOR LIGHT AND POWER.

BULLDOG
ELECTRIC PRODUCTS CO.
Detroit, Michigan

BullDog Electric Products of Canada, Ltd., Toronto, Ontario

Field Engineering Offices in All Principal Cities

Questions on the Code

[FROM PAGE 78]

a seal is provided to seal off the compartment, no seal is necessary at that point to seal the conduit.

If an official interpretation is desired, five identical signed letters should be sent to Chairman Alvah R. Small, 207 East Ohio Street, Chicago, Ill.

OFFICIAL INTERPRETATIONS

by the

Electrical Committee of the N.F.P.A.

Interpretation No. 238

QUESTION . . . In the case of a three-phase ungrounded service where up to six circuit breakers are employed in lieu of a main service overcurrent device (as permitted by sub-paragraph three of paragraph a of section 2371), must overcurrent units be provided in each phase for each of the up to six circuit breakers?

ANSWER . . . Yes, as specified in Interpretation **No. 64.**

Interpretation No. 239

QUESTION 1 . . . May conduit, pipe or electrical metallic tubing, of sufficient carrying capacity, be used as a common grounding conductor for an interior wiring system and for equipment?

ANSWER . . . No. Refer to section 2591-a.

QUESTION 2 . . . May such conduit, pipe or electrical metallic tubing be used (without a copper conductor) as the grounding conductor for service equipment?

ANSWER . . . Yes, if not also a common grounding conductor of the wiring system and except under conditions favorable to corrosion. See section 2591-b.

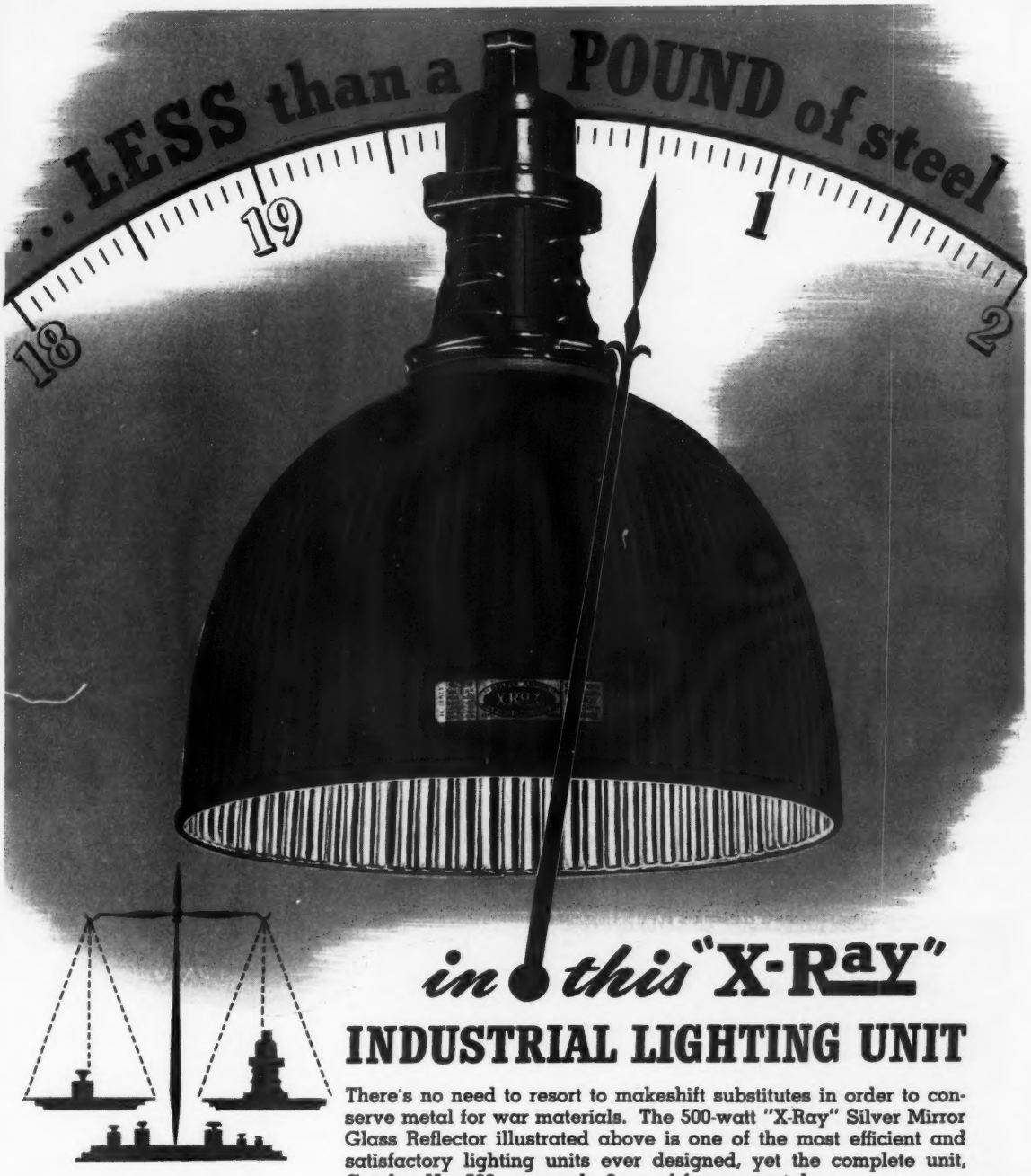
QUESTION 3 . . . Is there a contradiction in the note following the table of section 2594 with the limitation of paragraph 2591-b?

ANSWER . . . No; the word "alone" in the text of the note indicates that copper is to be used for the grounding conductor of the wiring system and that the conduit, pipe or electrical metallic tubing is for mechanical protection.

Beven Heads Milwaukee League

Harry Q. Beven was elected president of the Electrical League of Milwaukee at the recent annual meeting of that organization. Other officers of the group for 1943 are Bruno Barg, vice-president; Nels Christopherson, secretary; and Thomas Desmond, treasurer.

UMI



in this "X-Ray"

INDUSTRIAL LIGHTING UNIT

There's no need to resort to makeshift substitutes in order to conserve metal for war materials. The 500-watt "X-Ray" Silver Mirror Glass Reflector illustrated above is one of the most efficient and satisfactory lighting units ever designed, yet the complete unit, Catalog No. 588, uses only 9 oz. of ferrous metal.

"X-Ray" Silver Mirror Reflectors for industrial lighting are available in various sizes and types for incandescent lamps, up to 1500-watts, and also for the 400-watt Mercury lamp. Long life, low maintenance cost and ease of installation make them the natural choice for relighting industrial plants where lighting must be stepped up to meet wartime production standards. Write today for full information on "X-Ray" Reflectors.

Use "X-Ray" Reflectors and conserve critical materials for war purposes. A minimum amount of metal is required in the holder and socket. The reflector itself is made of crystal glass.

CURTIS LIGHTING, INC.

6135 W. 65TH STREET, CHICAGO

Modern Lighting

MERCURY-MAZDA TOOL SHOP LIGHTING

Adequate engineered lighting is one of the prime considerations in the design of one of the world's largest industrial units, the new Dodge Chicago Plant, Division of Chrysler Corporation. Typical of the lighting used throughout the manufacturing areas, is that of the tool shop.

An average illumination of 27 foot-candle intensity on the working plane is provided by a total of 170 high intensity, combination mercury-mazda lighting units, each containing one 400-watt mercury vapor lamp with three 150-watt incandescent lamps in a common reflector. Spacing varies from 18 to 20 feet on a staggered row pattern. Columns are on 20-ft. centers. Units in the 50-ft. span high bay area are mounted 24-ft., 7-in. from the floor. In the 25-ft. span low bay areas, the mounting height is 16 feet.

Savings in lamp transformers was effected by using the two-lamp type, each serving two lighting units. Fixtures are suspended from thin-walled conduit circuits with Type SN conductors embedded in the concrete slab of the arch-rib roof construction.

At the individual machines, where necessary, supplementary machine lighting with flexible arm units is employed. These are connected, through small individual transformers, direct to the 480-volt three-phase circuit feeding the machine motors.

The complete shop lighting system is fed from a total of twenty-two, 7½ KVA., 480/120/240-volt, single phase lighting transformers spotted throughout the building and connected to 480-volt three-phase bus duct lines running the length of the building. These ducts emanate from a unit substation at the 2400-volt, 3-phase, 3-wire building service.

General lighting is group controlled by means of magnetic contactors in the primary circuit of each transformer which serves approximately eight fixtures. Operation of the momentary contact push buttons, conveniently located on the columns, energizes or kills the transformer and all lighting units fed by it.

***ENGINEERED LIGHTING** permits maximum production in the tool shop of this large war plant. Combination mercury-mazda lighting provides an average of 27 foot-candles on the working plane.*

BALANCED LIGHTING

Lighting engineers working under war restrictions have come to realize some of the reasons and requirements for good lighting practices and, accordingly, are recommending lighting installations on the basis of individual requirements, whenever there are variations.

The reasons for any lighting installation are, naturally, to afford artificial illumination to enable workers to perform their tasks quickly, efficiently, safely and economically and with the least amount of eyestrain. This can be done most practically and economically by supplying two types of lighting equipment.

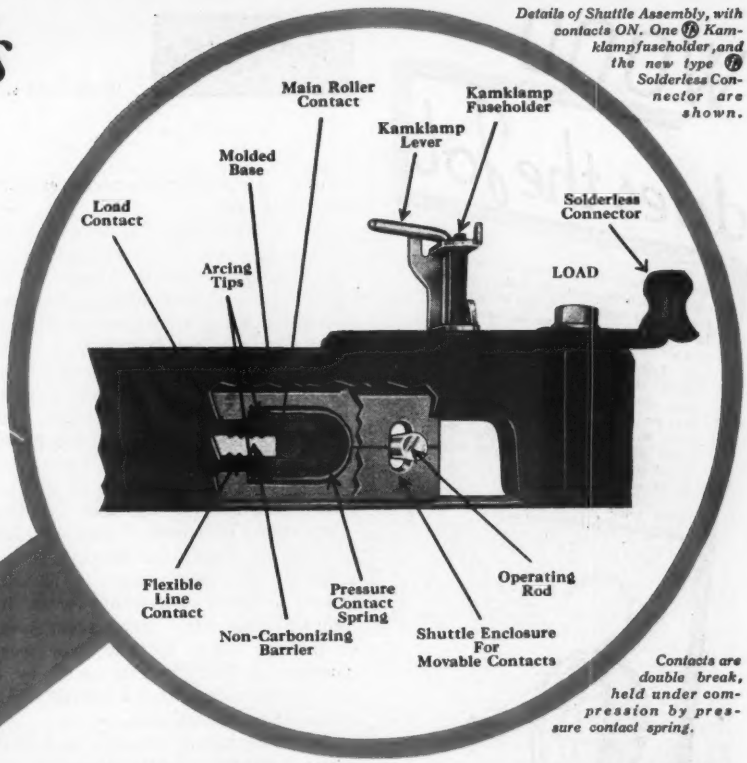
Localized lighting units providing higher levels should be installed on machines, benches, inspection tables, or wherever close-seeing tasks are performed. Selection of these individual units must be made entirely on the basis of the type of work being done at that particular place. Anyone recognizes that it takes less light and seeing ability to recognize a figure 6 inches high than the small figures and divisions on a micrometer. Further, it would be uneconomical to provide 300 f.c. of illumination to see the 6-inch figure when 100 f.c. are adequate. Likewise, it would be impractical and uneconomical to expect a worker to read a micrometer or perform other critical, precision work with 50 f.c. of general illumination only, when recognized lighting practice standards dictate 200 f.c. Care should be taken also when installing individual localized units, that they be properly positioned to remove chance of glare from the light source being reflected in the face of the worker or fellow workers.

Now, general lighting units should be installed, also, on at least a ratio of one to five with the localized lighting requirements. In other words, if the average localized lighting requirements for the close-seeing tasks are 100 f.c., then general illumination should be at least 20 f.c.

Some short-sighted person might reason that as long as adequate light is furnished for the critical work-areas, the extra light furnished by general lighting units is entirely wasted. Lighting

UMI

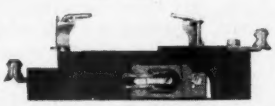
Thousands of these *Safety Switches* are helping produce War Materials..



Details of Shuttle Assembly, with contacts ON. One (FA) Kamklamp fuseholder, and the new type (FA) Solderless Connector are shown.

Contacts are double break, held under compression by pressure contact spring.

Contacts in OFF position.



Contacts in MAKE or BREAK position.

100 Amp., 575 Volt (FA) SHUTLBRAK Switch, Cat. No. SA-10633.

Some are used singly — others are banked in groups — or assembled in well-designed switchboards and panelboards. Still others are installed as Plugin Units for (FA) Busduct. But wherever and however it is used, this heavy duty industrial

(FA) SHUTLBRAK SWITCH

is giving efficient, dependable service on motor circuits — at service entrance — and on installations requiring an operating switch.

The (FA) Shutlbrak Switch is revolutionary in design. The contacts are *shuttled* on and off.

The roller type main contact and auxiliary contacts are enclosed in an insulated shuttle. This shuttle assembly in turn is entirely surrounded by insulating material. There is an arc resisting barrier at all times between the line and load contacts—and contacts are held under compression in ON position. Silver plated current carrying parts insure low resistance. Properly engineered springs assure quick make and quick break. It is equipped with (FA) Kamklamp (pressure type) fuseholders for either ferrule or knife-blade types of fuse terminals, and with the new (FA) Solderless Type Pressure Connectors.

As an additional safety factor, Type A is equipped with an interlocking arrangement between the switch operating lever and the door of the fuse compartment. The door cannot be opened when the handle is in the ON position. (Type B does not have this interlocking feature.)

(FA) Shutlbrak Switches are available for both surface and flush mounting. Enclosures have ample wiring space at top, and AT REAR of the switching mechanism. Fronts and cabinets are attractively finished in pearl gray enamel.

Capacities: 30 to 1200 amp., inclusive, for 250 volts AC or DC, and 30 to 600 amp., 575 volts AC, in 2, 3 and 4 poles. Approved by Underwriters' Laboratories, Inc.

For detailed information, and suggested specifications for (FA) Shutlbrak Switches, Panelboards and Switchboards, write for Bulletin No. 59 . . . Frank Adam Electric Company, St. Louis, Mo.

EST. 1891 — THE SIGN OF A (FA) BETTER JOB

Frank Adam

ELECTRICAL PRODUCTS

for War Industry

FRANK ADAM ELECTRIC CO.
ST. LOUIS, MO. U.S.A.

WOOD
does the Job

Rubber now is on the critical list which means that McGILL all-purpose wood handle guards will be used in affording protection in heavy-duty, high-pressure war industries . . . Over the years many large plants have found McGILL wood handle guards give complete satisfaction, because they're durable, wash easily, wear well in grease and oil. When you want portable guards, order McGILL wood handle guards. There is a type to fit every requirement.

Visit your wholesaler or write us for additional information.

Electrical Division

McGILL

MANUFACTURING CO., INC.
VALPARAISO, INDIANA

Modern Lighting

[FROM PAGE 82]

engineers and industrial executives have found this untrue.

The Breckenridge Machine Co. at Cleveland is one of those industrials who have given serious thought to the lighting problem and, accordingly, have installed lighting equipment on a "balanced" basis. The accompanying photo illustrates in part how they have accomplished this. Localized lighting units were installed on tool grinders and other machines not shown in the photo. The localized lighting units chosen for this job furnishes in excess of 200 f.c. of illumination for the tool grinding operation. Previously, workers had only 30 f.c. of light for the close-seeing tasks, which is not recognized as adequate for any close-seeing work by lighting engineers. Fluorescent units of the two lamp 40 watt type were mounted at 12-ft. heights on 8 by 8 feet centers to furnish the overall lighting at 35 f.c. maintained.

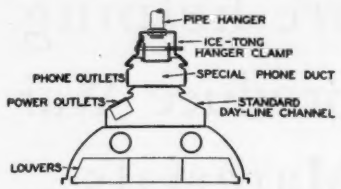
This installation is in a tool crib where lighting is usually neglected, but where critical seeing is involved. In this department it is necessary to select tools such as cutters, drills, etc., from racks which are identified by stamped markings, often difficult to read.

Workers say it is much easier to select tools from racks with the general lighting provided and that sharpening tools, etc., under the higher levels provided by the localized units is much more satisfactory. *Paul H. Krupp.*

POWER WIRES IN LIGHT CHANNEL

At one of the country's large air fields, a section of the Command Building normally allocated for storage was required for quick conversion to office and engineering space. As this area was originally intended for storage, there were no accommodations for phone or power lines other than the original ceiling outlets spaced one to each 20-foot bay.

In converting this area it was necessary to provide power outlets for adding machines and other electrically operated



***POWER** and phone wires are run in fixture wiring channels for quick and flexible installation.*

business machines as well as telephone outlets. These requirements, coupled with the problem of supplying adequate illumination for the entire area within 30 days time presented what looked like a physical impossibility.

H. C. King, Day-Brite Lighting, Inc. as a consultant suggested a combination "lighting-power-phone duct" system that has met the requirements and provides a flexible means of providing access to the various electrical systems.

Standard industrial fixtures in continuous lengths were used as a basic channel and provided sufficient wireway space for both the lighting and power

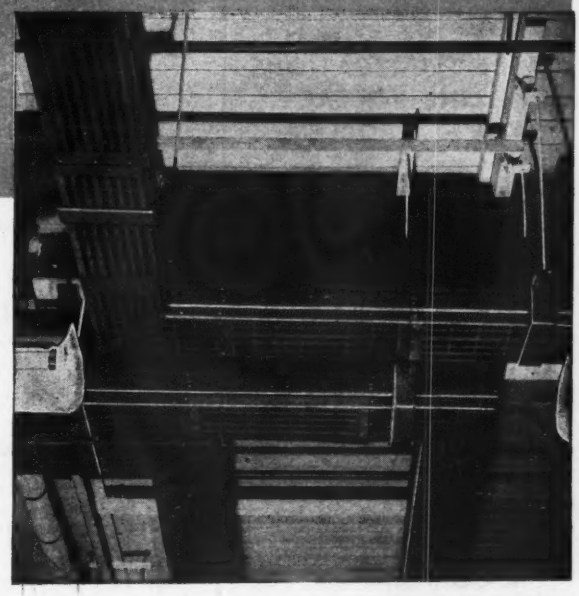
***LOCAL LIGHTING** supplements high quality general illumination in this Cleveland industrial plant.*

UMI

TRUMBULL design . . . NEW W.P.B. ratings

L.V.D. system and FLEX-A-POWER

conform to limitation order L-273



- **EFFECT IMPORTANT STEEL AND COPPER SAVINGS**
- **CAN BE USED WITH TRUMBULL SYSTEMS ALREADY INSTALLED**
- **ASSURE COMPLETE MECHANICAL AND ELECTRICAL PROTECTION**
- **SIMPLIFY INSTALLATION ENGINEERING**

L. V. D. **The Trumbull "Airated" L.V.D. (LOW VOLTAGE DROP) Feeder System** was the first thoroughly engineered approach to the problem of main electric power feeder distribution in industrial plants effecting MAXIMUM ECONOMY in use of copper and steel for a given load capacity, and at the same time showing EXTREMELY LOW VOLTAGE DROP.

This system is now available, embodying tried and proved Trumbull design features and in conformance with W.P.B. Limitation Order L-273, in the following range of current ratings: 250, 400, 600, 800, 1000, 1350, 1600 and 2000 amp. Efficiently ventilated metal protective enclosures completely house and protect bus bars that are individually encased in high-temperature resisting CARBONOT sheathes. The entire structure is rigidly braced against electrical and mechanical stress with short circuit ratings 100,000 R.M.S. amperes and over. Improved Vystipe bus bar connectors and silver plated joints,

Here is your answer to urgently needed power capacity expansion . . . assuring *full voltage at point of load, maximum economy* in use of vital materials . . . electrical and mechanical safety . . . flexibility and full salvability to meet future changing needs.

FLEX-A-POWER Without departing from Trumbull design standards for electrical efficiency, safety and performance, FLEX-A-POWER Plug-in Systems and FLEX-A-PLUGS now conform to W.P.B. Limitation Order L-273. New standardized current *ratings are 250, 400 and 600 amp.*, with the smaller size 125 amp. FLEX-A-POWER and Plugs redesigned to rate 250 amp. without change in dimensions.

Note especially that, while cooperating to the fullest extent in conservation of vital materials and simplification of ratings, FLEX-A-POWER maintains the high Trumbull standards for quality of construction, carefully engineered electrical and mechanical design and unlimited flexibility in application. Bus bars are still completely enclosed in strong steel housings . . . fully protected electrically and mechanically. **Bus bar sections and plugs are interchangeable with Flex-A-Power equipment already installed.**

◆

Trumbull Engineers are fully conversant with the requirements of Limitation Order No. L-273. They will be glad to help you in the planning and installation of L.V.D. or Flex-A-Power System in conformance with its terms.

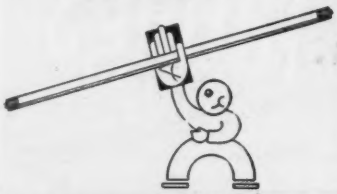
TRUMBULL

ENCLOSED BUS BAR SYSTEMS

THE TRUMBULL ELECTRIC MANUFACTURING COMPANY • PLAINVILLE, CONN. • A GENERAL ELECTRIC ORGANIZATION

OTHER FACTORIES AT NORWOOD (CINN.) O. — SEATTLE — SAN FRANCISCO — LOS ANGELES

"LONG LIFE"* says:



"WIDE FLUCTUATIONS IN LINE VOLTAGE ARE NO PROBLEM

for

ARTKRAFT HOT CATHODE FLUORESCENT LIGHTING"

SIGNS* OF LONG LIFE

Here's Why:

Wide fluctuations in line voltage does not rule out modern fluorescent lighting when the Artkraft Hot Cathode Lighting System is used, because Constant Voltage power packs, an exclusive Artkraft feature, assure efficient operation at 85 to 135 volts. This means that a good lighting job can be done with Artkraft equipment where bad voltage conditions or overloaded lines would make it impossible with any other known equipment. It is also adaptable to 220 and 440 volt operation in single or three-phase. Also the current-limiting characteristics of Constant Voltage cause the voltage to go to zero when a short occurs and it remains at zero until short is relieved—it will not blow a primary fuse.

OTHER EXCLUSIVE FEATURES OF ARTKRAFT ARE:

NO STARTER SWITCHES:

This bugbear of fluorescent lighting is eliminated by the resonant starting of Constant Voltage.

GUARANTEED LAMPS:

The Artkraft Hot Cathode Lamp is guaranteed 3,000 hours, with a rated life of over 5,000 hours. It has been field tested under adverse conditions for over five years. Blackening in light column is reduced by exclusive cathode design, assuring a brighter lamp.

100% POWER FACTOR—

at rated voltage and 98% or over within 85 to 135 volt range. (In almost all cases will not vary more than 98% to 2% leading.)

"EASY MOUNT" NON-FERROUS REFLECTOR:

Permits instant mounting or removal for cleaning without the use of tools.

Artkraft exclusive features greatly reduce maintenance costs. No starter switches to replace. Lamp replacements less frequent. Ballast replacements unknown. More hours saved by making these replacements unnecessary.

WRITE FOR FOLDER F-102

WHOLESALERS:

Write for our proposition

FIXTURE MANUFACTURERS

We are pleased to announce that the Artkraft Hot Cathode Fluorescent Lighting Systems are now available through the manufacturing and distributing facilities of the

EDWIN F. GUTH COMPANY
F. W. WAKEFIELD BRASS COMPANY
and
FOSTORIA PRESSED STEEL CORPORATION

Their products will henceforth be known as Guth-Artkraft Fixtures, Wakefield-Artkraft Fixtures and Fostoria-Artkraft Fixtures. Other fixture manufacturers who have not as yet investigated the Artkraft license proposition are urged to do so at once.

ARTKRAFT

Hot Cathode Fluorescent Lighting

Division of

THE ARTKRAFT SIGN CO.

1113 E. KIBBY ST.

LIMA, OHIO, U. S. A.

* Reg. U.S. Pat. Off.

Modern Lighting

[FROM PAGE 84]

supply. The channel was provided with receptacles at regular intervals for the operation of the business machines. Bolted to the top of this channel was another channel which served as a duct for the phone wiring and outlets. The entire assembly was supported from the ceiling by means of "Ice-Tong" hanger clamps and pipe hangers. These clamps provided sufficient longitudinal adjustment to allow very flexible spacing of the pipe hangers.

A 4-wire, 3-phase power line was used providing 120/208 volts for the business machines and lighting. The 208-volt ballasts, were used to save vital copper. Levolier pull switches were furnished with all fixtures as it was impractical to do any wiring through the walls. There were approximately 3,000, 2-lamp, 40-watt reflectors used on this job and hinged louvres were furnished for shielding.

A very satisfactory job resulted, providing plenty of electrical and phone outlets, 40 foot-candles of illumination and a speedy trouble-free installation that met the time requirements. Patents have been applied for covering this idea.

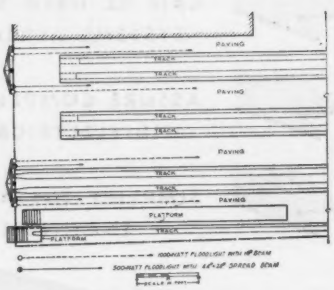
Lighting A RAILROAD YARD

PROBLEM: To light the ground area and the sides of the freight cars for truck loading and protection.

CONSTRUCTION DATA: This unloading area is approximately 600 ft. by 300 ft. There are three double tracks and one single track where the freight cars are unloaded. Produce arriving on trains unloading here during the night must be handled swiftly so that it can be delivered for the early morning markets. Poles carrying floodlights could not be located within the working area as trucks must be able to move freely on the driveways between the tracks.

SOLUTION OF PROBLEM: The area is floodlighted by projectors mounted on cross-arms on poles at the ends of tracks.

Two 75-ft. poles were located at the south end of the area and equipped with cross-arms having an extension of 20 feet each side of the pole. At each end of the cross-arm are two projectors: one 500-watt unit, with spread beam to light the foreground; and one 1000-watt unit, with narrow beam to reach the more distant parts. All projectors are 60 feet above the ground, mounted on Thompson disconnect hangers which permit the projector to be easily lowered for maintenance. Had the lowering chains of the disconnects been fed through pulleys parallel to the cross-arm and down the pole rather than directly from the ends of the cross-arm, operation would have been easier.



LOCATION of pole mounted projectors to avoid obstruction in the truck driveways.

FLOODLIGHTING the loading area of a freight truck yard with projectors mounted on pole cross-arms.

UMI

The electrical conduit you see in this picture carries important power and control circuits in a sewage treatment plant. Conditions there are conducive to corrosion, but this conduit is "good as new" after seven years of service. No rusting to destroy the conduit or cause trouble with the wiring.

Of course, you can't buy Alcoa tubing for conduit today, although tons of tubing are being made. It's all going into airplanes and other fighting equipment. But the splendid performance of prewar installations suggests that aluminum tubing may be a "must" for those postwar jobs where corrosion is likely to be a problem.

Light in weight, aluminum conduit places less burden on its supports. It is easy to fabricate and install. Fittings will become available as soon as metal is released for peacetime projects. These advantages, added to its long, trouble-free life, make Alcoa Aluminum tubing a most economical material to use.

As you draw up plans for postwar construction, you should be considering the advantages offered by aluminum conduit and other Alcoa Aluminum products. We'll gladly send you any data you need. Write ALUMINUM COMPANY OF AMERICA, 1946 Gulf Building, Pittsburgh, Pennsylvania.

ALCOA ALCOA ALUMINUM **ALUMINUM**

SHOCK and WEATHER-PROOFED

Labor Burden As a Cost

[FROM PAGE 39]

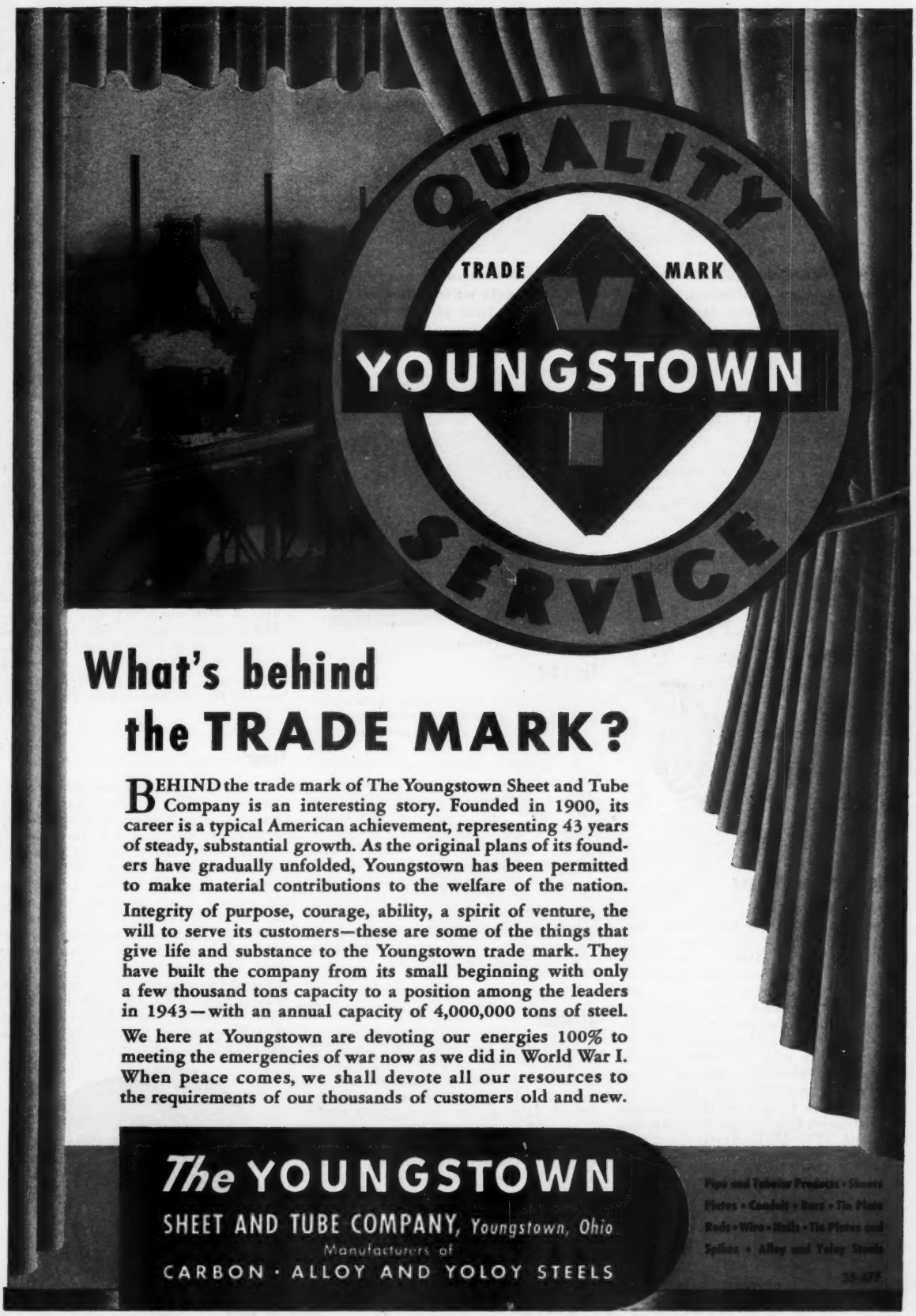
$1,333 per mechanic to meet operating costs. If his business drops to $15,000, he must earn approximately $2,542 per mechanic to come out even—an increase of about 90 percent.

Suppose this same contractor becomes ambitious and decides to build up his organization to handle a $60,000 volume. He may be able to secure sufficient business for a short period, then find that his volume has dropped back to the $30,000 level. With a $60,000 plant and a $30,000 business he finds that it is costing him $1,760 per mechanic employed, instead of the $1,333 when he had a $30,000 organization. Unless he can assure himself of a $60,000 normal volume, he will not reduce his cost per mechanic to the $940 shown under Column "K" and should stay in his $30,000 bracket.

When can a contractor expand his organization? The last line in each classification noted "Temporary Condition" shows the stepping stone. Here his organization and equipment are temporarily overworked. If the volume of business continues to grow, he can consider expansion. If not, he should stay put. Many contractors who have expanded rapidly just to be "big contractors" have soon wound up much poorer, but wiser (the latter being questionable). Some of them, regardless of how poor they get, hang on. As Walter Collins says, "They go on donating their time and services from year to year, hoping that some day they will hit the jackpot." But that day may not come. In the meantime overexpanded organizations while sparring for business, produce an unhealthy condition in the electrical construction field.

WARTIME BUSINESS problems are discussed at the NISA War Conference by (L to R) W. H. Taylor, G. E. Co., Charlestown, W. Va.; T. J. Kieley, Kieley Electric Co., Cincinnati, O.; and Arthur Hurst, G. E. Co., Cincinnati.

UMI



What's behind the TRADE MARK?

BEHIND the trade mark of The Youngstown Sheet and Tube Company is an interesting story. Founded in 1900, its career is a typical American achievement, representing 43 years of steady, substantial growth. As the original plans of its founders have gradually unfolded, Youngstown has been permitted to make material contributions to the welfare of the nation.

Integrity of purpose, courage, ability, a spirit of venture, the will to serve its customers—these are some of the things that give life and substance to the Youngstown trade mark. They have built the company from its small beginning with only a few thousand tons capacity to a position among the leaders in 1943—with an annual capacity of 4,000,000 tons of steel.

We here at Youngstown are devoting our energies 100% to meeting the emergencies of war now as we did in World War I. When peace comes, we shall devote all our resources to the requirements of our thousands of customers old and new.

The YOUNGSTOWN
SHEET AND TUBE COMPANY, *Youngstown, Ohio*
Manufacturers of
CARBON · ALLOY AND YOLOY STEELS

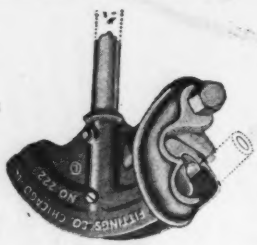
Pipe and Tubular Products • Sheets
Plates • Conduit • Bars • Tin Plate
Rods • Wire • Nails • Tie Plates and
Spikes • Alloy and Yoloy Steels

EQUIPMENT News

THESE ANNOUNCEMENTS of new equipment are necessarily brief—for more detailed descriptions, sizes, prices and other data write to the manufacturers' advertising departments, tell them in what issue of ELECTRICAL CONTRACTING you saw the item and they will send full details to you.

Conduit Bender

A new double duty ½-, ¾- and 1-in. thin wall conduit bender with improved gravity and foot release hook. By releasing the pressure of the conduit with the right hand, the hook will move out of the engaged position by gravity and allow the conduit to be removed without touching the hook by hand. The foot control of hook can be disengaged by using toe on lever. It also has limit stops which control movement from a disengaging position to a closing position. Lew-Fittings Co., 628-30 W. Jackson Blvd., Chicago, Ill.



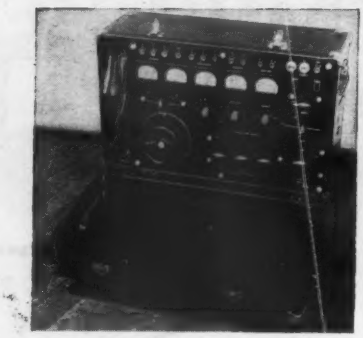
LEW-FITTINGS BENDER

■

Outlet Box and Hanger

This porcelain outlet box is round at the top and flat at the bottom and takes up to three conductor No. 12 non-metallic sheathed cable. It is 4-in. octagon, and 1½ in. deep. It has two cable knockouts in each of two opposite sides. Also one ½-in. conduit knockout, two fixture stud bolt holes and two supporting holes in bottom, complete with cover screws. For use on these boxes there are three types of hangers available—the shallow offset, deep offset and Universal type. The Universal bar hanger is 16½ in. long; complete with ⅜ in. sliding set screw fixture stud. The M. B. Austin Company, 108 South Desplaines St., Chicago, Ill.

AUSTIN OUTLET BOX AND HANGER



WESTINGHOUSE TEST KIT

Test Kit

To test relays and electrical operation of 125/216 volt secondary network protectors, a new portable test kit has been announced. It is designed for routine testing in the field. Variable currents and voltage for relay testing and mechanism operation are obtained by means of fixed resistors, a transformer, and a variable autotransformer designed for continuous control of voltage. Other equipment in kit includes voltmeters to check line voltage; ammeters to check relay reverse current; switches to alter all circuits necessary to test master relay; red and green indicating lights; fuses to protect supply circuit; and supply and test leads. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

■

Stripper

A stripping medium, known as S-159 stripper, provides fast and easy removal of insulating varnish from portions of electrical equipment where varnish is not desired. It is a blue viscous liquid which is brushed on machined surfaces or other metal parts prior to the application of the varnish to the piece as a whole. It dries in two or three minutes after which the varnish is applied in the usual manner. When the varnish treatments are finished, any varnish which has adhered to the portions previously treated with the stripper can be removed with a wood or bakelite knife. The Sterling Varnish Company, 122 Ohio River Blvd., Haysville, Pa.

R.C.P. MULTITESTER

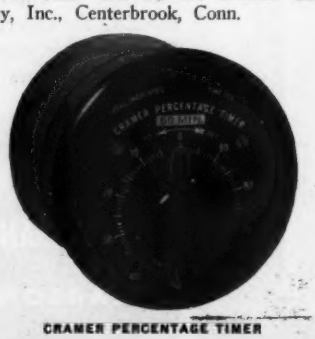
Instrument

The new Model 419 multitester combines in one instrument, a.c.-d.c. voltmeter, milliameter, ammeter, capacity meter, ohmmeter and inductance meter. It is suitable for a wide range of shop, laboratory and field applications. It uses the new system of a.c. measurements, eliminating the copper oxide rectifier. The a.c. scales are linear with d.c. scales. Sensitivity of meter is 2,000 ohms per volt. Capacity-meter is direct reading with widespread scales. Ohmmeter has self-contained power supply. Meter is fused and supply line double fused. Radio City Products Co., Inc., 127 W. 26th Street, New York, N. Y.

■

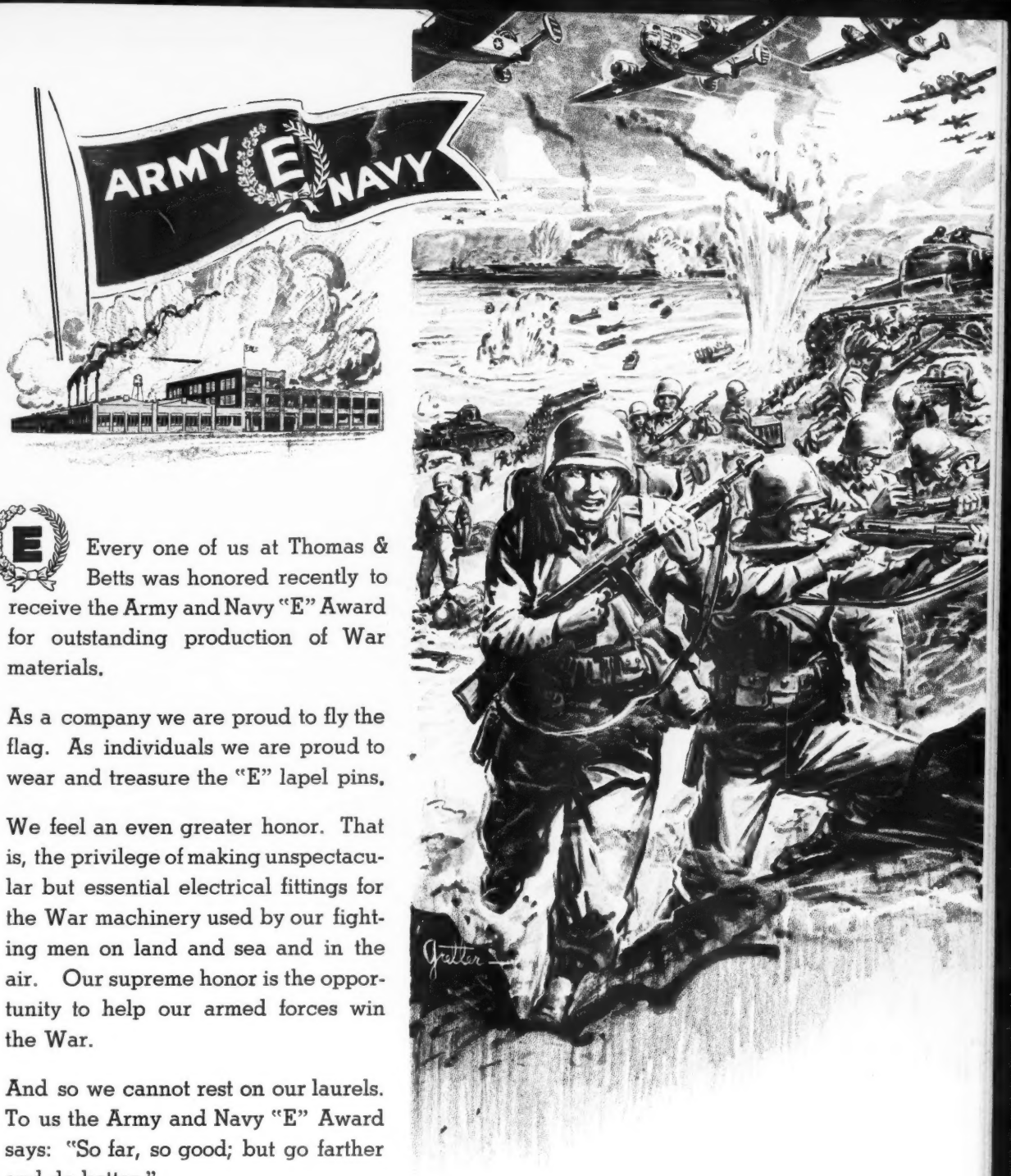
Timer

A new percentage timer, which automatically controls the percentage of time at which any a.c. circuit can periodically be closed or opened out of a definite length of a time cycle, is available. It has a self-starting synchronous motor which drives a cam operated switch mechanism. Varying the position of the stationary cam alters the relation between the contact mechanism and opens and closes it a definite percentage of the total cycle as indicated on the dial. The timers are available for seven different time ranges from 30 seconds to 60 minutes total cycle. The single pole, single throw contact is rated at 5 or 10 amps. at 115 volt. The R. W. Cramer Company, Inc., Centerbrook, Conn.



CRAMER PERCENTAGE TIMER

UMI



Every one of us at Thomas & Betts was honored recently to receive the Army and Navy "E" Award for outstanding production of War materials.

As a company we are proud to fly the flag. As individuals we are proud to wear and treasure the "E" lapel pins.

We feel an even greater honor. That is, the privilege of making unspectacular but essential electrical fittings for the War machinery used by our fighting men on land and sea and in the air. Our supreme honor is the opportunity to help our armed forces win the War.

And so we cannot rest on our laurels. To us the Army and Navy "E" Award says: "So far, so good; but go farther and do better."

OUR ENTIRE PERSONNEL

T&B

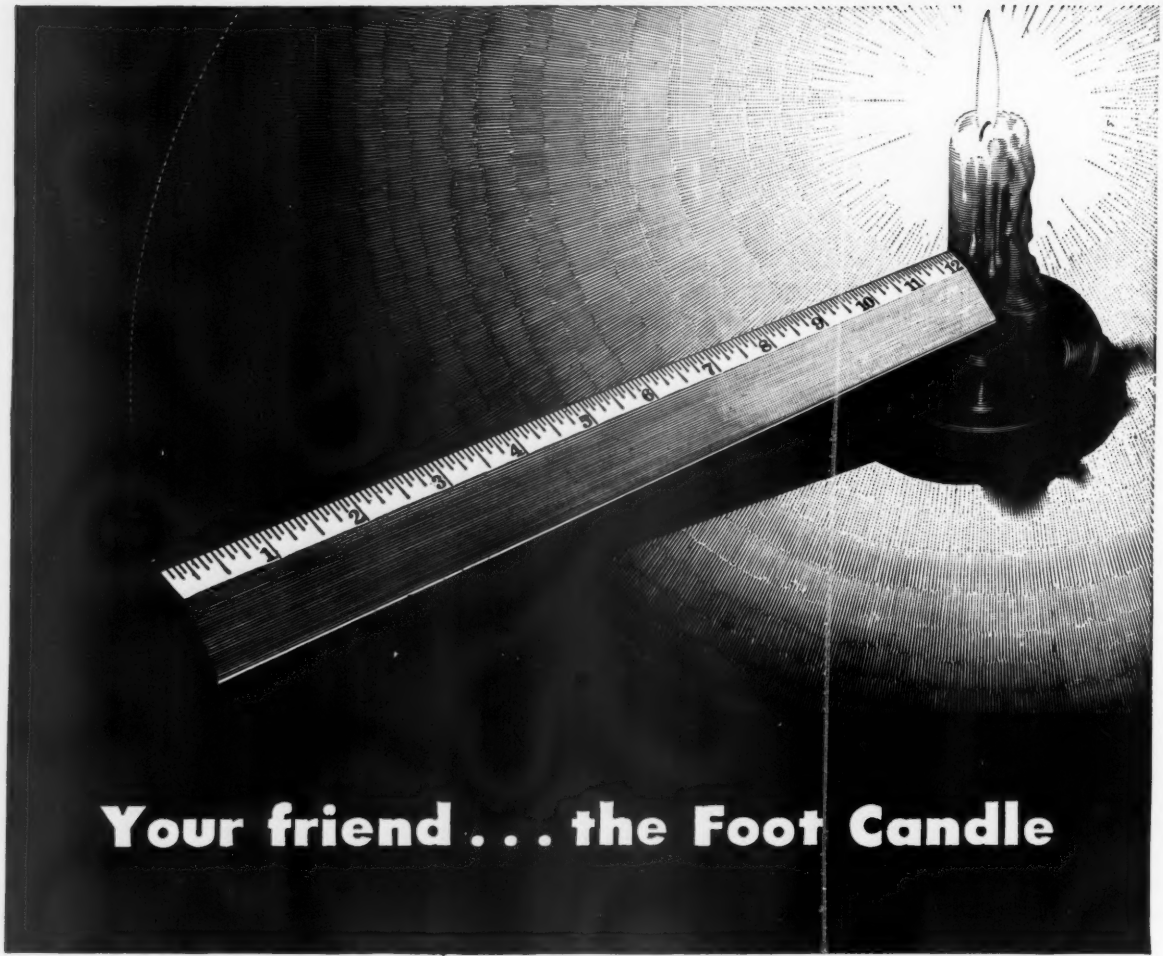
THE THOMAS & BETTS CO.

INCORPORATED

MANUFACTURERS OF ELECTRICAL FITTINGS SINCE 1899

ELIZABETH, NEW JERSEY

In Canada: Thomas & Betts Ltd. Montreal



Your friend . . . the Foot Candle

A FOOT CANDLE is the illumination from one standard candle on a surface one foot from the light source.

It is the unit of measurement of illumination. But more than this, the foot candle is man's staunch friend.

In adequate amounts it means his family will have sufficient light in the home . . . he and his fellow workers sufficient light for better, safer factory production or efficient office detail.

For almost 100 years the MILLER organization has known the foot candle on working terms. This lighting experience bridges the broad ground from the whale oil lamp to the modern continuous fluorescent lighting system now helping industry speed out planes and tanks and cannon.

It has involved engineering and design and skill with copper . . . glass . . . steel . . . aluminum and many new non-metallic materials. It has required ingenuity and resourcefulness and pioneering.

It qualifies us to work with those who need better lighting in war industry. It enables us to cooperate intelligently with those who promote better lighting and sell and service it, too. It means that the MILLER engineer (located in principal cities) can serve you in one of several ways, for better lighting today and tomorrow.

THE MILLER COMPANY · MERIDEN, CONNECTICUT

ILLUMINATING DIVISION
Fluorescent, Incandescent
Mercury Lighting Equipment

OIL GOODS DIVISION
Domestic Oil Burners
and Liquid Fuel Devices

ROLLING MILL DIVISION
Phosphor Bronze and Brass
in Sheets, Strips and Rolls

WAR CONTRACTS DIVISION
War Materiel

MILLER
SINCE 1844

UMI

EQUIPMENT News

[FROM PAGE 90]

Motors

A new line of vertical hollow shaft explosion proof motors for operation in Underwriters' Class I Group D hazardous gas locations has been announced. These motors are designed primarily for pumps handling large quantities of volatile materials such as high octane aviation gasoline. Numerous applications are arising requiring motors designed to prevent explosions and fires and these motors are recommended to minimize this hazard. Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago, Ill.

FAIRBANKS, MORSE MOTOR

■

Drills

These new drills have "Drillite" plastic housings on the ¼-in. and ⅜-in. models. "Drillite" plastic is made with a shredded cotton duck base, which gives it a high impact resistance. The plastic is also heat resistant and insulator against dielectric shock. Steel inserts have been cast into the plastic housings to carry all ball-bearings and threaded steel inserts in the field housing for housing assembly screws. Steel air vents in commutator end housing gives motor ventilation. Both units are available with either end handle or side handle control, equipped with the "pistol grip and trigger switch"; and with Universal motors, operating on either alternating or direct current. Black & Decker Mfg. Co., 600 East Pennsylvania Avenue, Towson, Md.

BLACK & DECKER DRILLS

Latrobe PRODUCTS

★ FLOOR BOXES ★ WIRING SPECIALTIES ★

HIGH QUALITY

EASILY INSTALLED

Save Installation Time— Get Better Results

Latrobe products are "naturals" for wartime jobs. They may be easily and quickly installed and may be depended upon for long trouble-free service in all industrial, commercial and residential work.

No. 100 Box with No. 206 Nozzle

Latrobe non-adjustable watertight floor boxes represent the last word in design, fewest number of parts, least amount of time to install.

"BULL DOG" Insulator Supports

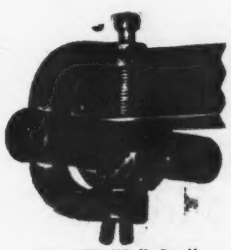
For fastening porcelain or glass insulators to exposed steel framework. Quickly attached, no holes to be bored. Four sizes.

No. 140 Floor Box

Latrobe Watertight Floor Boxes for quick installation in concrete and wood finished concrete floors. Neat design. Few parts.

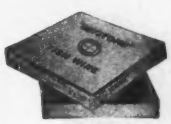
No. 284 Nozzle

This "Latrobe" Duplex Receptacle Nozzle is very neat and compact. Furnished with ½" or ¾" brass pipe extension.



No. 470 "Bull Dog" Pipe or Conduit Hanger

For hanging ½", ⅜" and 1" pipe or conduit to steel beam ⅜" thick. Also ground clamp. Will accommodate copper wire Nos. 8 to 4.



Keystone Fish Wire

Made of finest grade flat steel wire properly tempered. Ten sizes. Packed 100, 150 and 200 foot coils. Other lengths if required.

FOR BEST RESULTS
STOCK LATROBE PRODUCTS
SELL LATROBE PRODUCTS

DURABLE

ECONOMICAL

FULLMAN MANUFACTURING CO. QUALITY AT LATROBE OB SUPREMACY LATROBE, PA.

FULLMAN MANUFACTURING CO.
LATROBE . . . PENNSYLVANIA

UMI

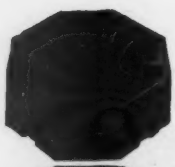
Save with ILLINOIS All Porcelain WIRING SYSTEMS....

★ USE LESS VITAL MATERIALS
★ DO JOBS IN LESS TIME
★ CUT MAINTENANCE

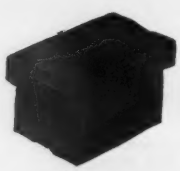
For the customer, porcelain protected wiring systems mean permanency of installation, economy, safety, dependable service where dampness and fire hazards are prevalent.

Illinois all porcelain wiring systems are adaptable to practically all wiring plans and layouts—they are easy to install and can be installed without grounding.

Porcelain is not a critical material—use it for your next installations.



OUTLET BOXES AND COVERS



SWITCH BOXES AND COVERS

TOGGLE SWITCH PLATE

★ SAVES VITAL MATERIALS
★ DO JOBS IN LESS TIME
★ CUT MAINTENANCE ★

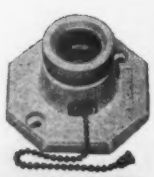
Bull Dog

Look for this Trade Mark

STANDARD TUBES

STANDARD KNOBS

CLEATS



LAMP HOLDERS

ILLINOIS ELECTRIC PORCELAIN CO.
MACOMB, ILLINOIS

EQUIPMENT NEWS

[FROM PAGE 93]

Instrument

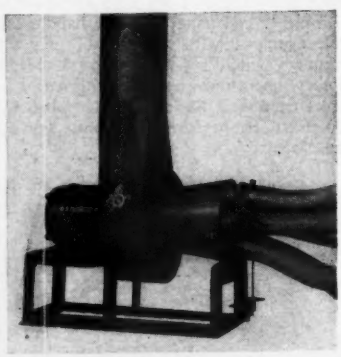
Two new Megger insulation testers have been announced. One is the variable-pressure "Meg" type and the other is the constant-pressure "Super-Meg" type. The direct-reading true ohmmeter indicates insulation resistance by pointer deflection. There are no keys to press or any dials to adjust, and the accuracy is independent of the speed of turning the hand cranked generator. The self-contained generator for hand operation supplies the testing potential so the instrument is available for service anywhere. The testers have a molded plastic case. James G. Biddle Co., 1211 Arch Street, Philadelphia, Pa.

BIDDLE TESTER

■

Fume Exhauster

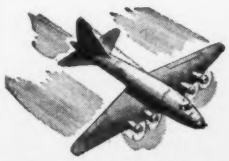
This new and improved fume exhauster is for use in shipholds, welding rooms, tunnels, vaults and basements. The new features of the unit are that the fumes, gases, dust, filings and grinding compounds do not come in contact with the motor. The centrifugal type blower wheel is made of ¼-in. steel. The three-horsepower ball bearing motor is tested to an overload capacity. The frame work is welded into a heavy unit with handles for carrying. The adapters are interchangeable and can be used for suction or blowing as desired. Chelsea Fan & Blower Co., Inc., 1206 Grove Street, Irvington, N. J.



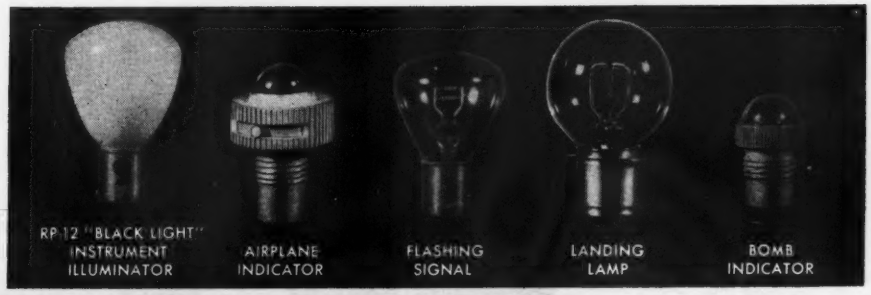
CHELSEA FUME EXHAUSTER

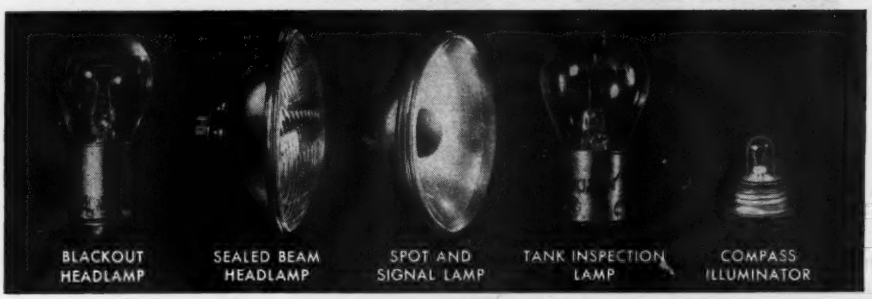
UMI

It takes some queer looking G-E lamps to fight a war!



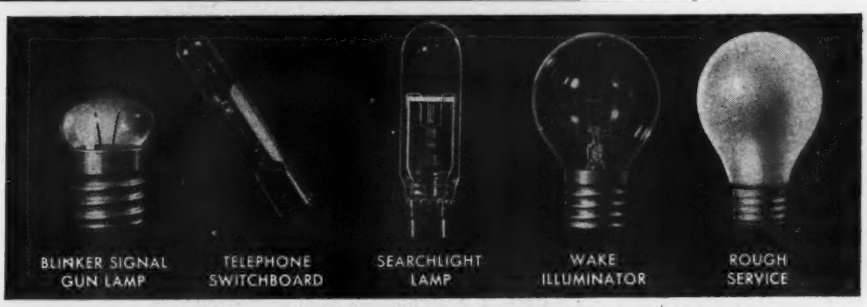
Every time a bomb leaves an American bomber, a tiny light signals to the bombardier. Chances are it's a G-E lamp, one of more than 200 developed for aviation needs.

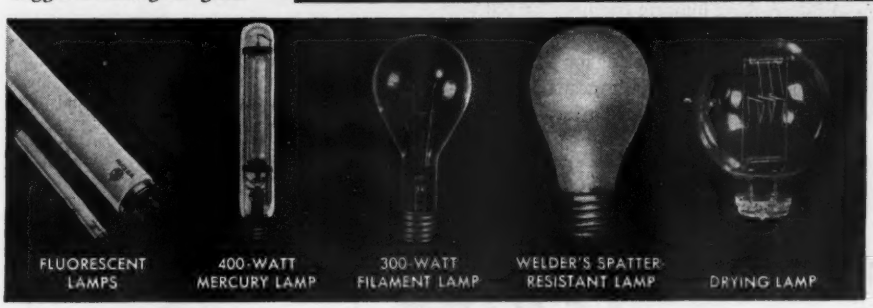




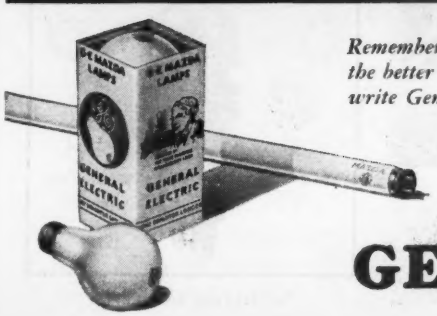
To help keep its tanks, jeeps, half-tracs and other military vehicles rolling, the U. S. Army is using more than 70 different types and sizes of G-E lamps.

The U. S. Navy uses 102 different types and sizes of G-E lamps, ranging from a 10½-inch searchlight lamp to a tiny flashlight lamp used in trigger-action signal "guns."





On the industrial front, many different G-E MAZDA lamps help production by making seeing easier and by speeding industrial processes.



Remember, G-E lighting engineers are ready to work with you to give war plants the better light they need for better production. See your nearest G-E lamp office or write General Electric Company, Lamp Dept. 166 EC-5, Nela Park, Cleveland, O.

G-E MAZDA LAMPS

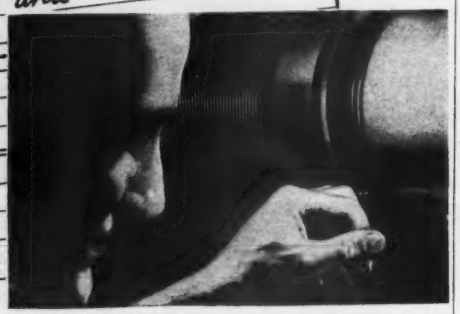
GENERAL ELECTRIC

RE-LIGHTING
the new manpower / production requirement

OPERATION STUDY SHEET

Working Conditions *Poor light, caused by improperly located lamps. Heavy shadows on work area confuse and slow up worker... considerable spoilage—accident hazard.*

Machine No. *349*
Capacity
Size
Department



Vital to reduce rejects, increase production

Operation study sheets all too often record "poor light" as a major cause of poor quality production—of too many units that cannot pass inspection. This condition is particularly noticeable on night-shift work because—

Most plants operating today were designed and built for peacetime, *daylight* working schedules. Wartime production demands night work; and *lighting based on daylight conditions is inadequate to serve the needs of night workers.*

The answer to this problem is *re-lighting.* You can quickly, easily, and with little expense increase the efficiency of your present lighting equipment by re-locating lamps to eliminate glare and shadow, increasing lamp wattages where necessary, or installing additional equipment to insure uniform lighting levels throughout your plant. A Silv-A-King lighting engineer can tell you exactly what is necessary.

Silv-A-King has specialized in industrial lighting for 22 years. Silv-A-King quality equipment (fluorescent or incandescent) plus a Silv-A-King "engineered layout" makes an unbeatable combination.

BRIGHT LIGHT REFLECTOR COMPANY, INC.
1033 Metropolitan Avenue, Brooklyn, N.Y.

Send for your copy of our 16-page book: "Light Is An Essential Production Tool"

SILV-A-KING
MAKES *Light* WORK FOR YOU

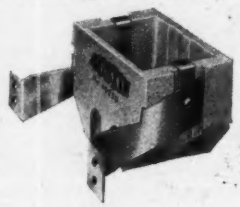
BROILKING AFTER THE WAR, MORE THAN EVER *America's Finest Electric Table Broiler*
INTERNATIONAL APPLIANCE CORPORATION
1827 Metropolitan Avenue, Brooklyn, N. Y.

EQUIPMENT News

[FROM PAGE 94]

Switch Box

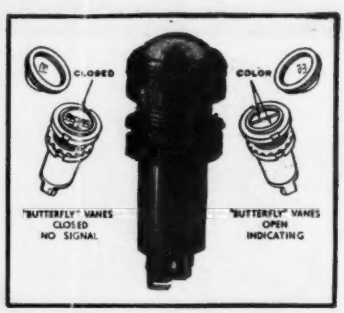
This porcelain switch box has beveled corners and is 2¼ in. deep, 3 in. long and 2 in. wide. There are two cable knockouts in each beveled corner and two in each side. Also one ½-in. conduit knockout; two fixture stud bolt holes and two supporting holes in bottom. They are furnished with No. OE-1 adjustable steel mounting ears. The ear may be adjusted to any point up to 1½ in. from top of box. This makes it possible to bring the box flush with the finished surface regardless of how thick the surfacing material may be, such as sheet rock, wall board, beaver board, lath and plaster. The M. B. Austin Co., 108 So. Desplaines St., Chicago, Ill.



AUSTIN SWITCH BOX

Indicator

This new indicator, called the "Signalette", works in daylight, under "black light." Indication by this unit is by reflected light and radio activity. It operates by fluorescence under "black light" from the usual sources. A radium-active fluorescent paint used on the indicator shows signals in total darkness. The body of the Signalette indicator houses a solenoid, the armature of which is connected with the "butterfly" indication vanes by a lever hookup. The fluorescent "butterfly" opens instantly to show signals, reflecting the proper indicating light. "Butterflies" are furnished in red, amber and green. When not indicating Signalette is black. The indicator was designed for use in aircraft but can be used in other fields as well. Littelfuse Incorporated, 4757 Ravenswood Avenue, Chicago, Ill.



LITTELFUSE SIGNALETTE

UMI

1941 **Calling their floors...** comfort and convenience taken for granted. In skyscraper and apartment house elevators, Americans expected and got precision service. Edwards annunciators flashed the floor signal, just one of many communication devices for home and industry.

1943 **Calling their shots....** Today, Edwards signals step up the striking power of British tank crews, providing the split-second coordination for battering Rommel's Afrika Korps. This is typical of the high speed communications Edwards makes for the United Nations.

194? Task force for tomorrow's way of living

Allied tanks shatter the desert silence with the clatter of attack... Bombers make their daily deadly sweeps... Destroyers, PT boats churn the seven seas... Each is a complex mechanical masterpiece brought to perfection by the task forces of science. In America, Edwards is part of that task force, developing high-speed communications equipment for land, sea and air forces. But Edwards, together with you, America's engineers, architects, builders, comprise *a task force for tomorrow's way of living*... Soon, the myriad advancements of war-science will be applied to peace. The communications equipment of tomorrow will bring undreamed-of progress. Edwards Post-War Research is planning today for that era of rebuilding.

ARMY E NAVY

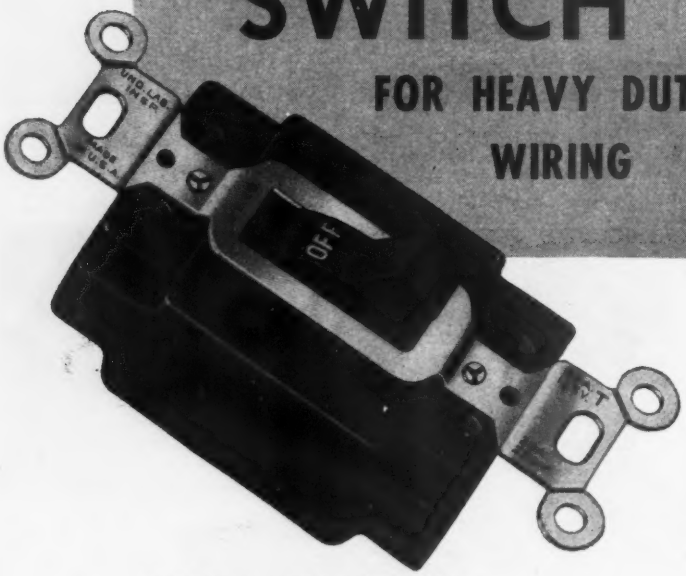
Edwards and Company, Norwalk, Conn.

EDWARDS

SINCE 1872

Communication Equipment for Homes, Institutions and Industry

Use the G-E
PRESSURE TERMINAL SWITCH
FOR HEAVY DUTY WIRING



Available in single-pole, double-pole and 3-way types; 20- or 30-ampere

THESE totally enclosed Textolite switches with pressure terminals will save installation time and provide secure connections. Just insert wire in pressure terminal and tighten screw. Wire as large as No. 8, solid or stranded, can be used. Arc snuffers give them a high rating.

Moreover, these switches are only 1¼ inches deep and will fit in shallow switch boxes. They are back wired providing more wiring room. They have easy, smooth, positive action and are quiet for switches of their capacity. Their wide mounting ears have lugs that may be broken off and used as washers, if desired. They are listed by catalog number, GE2971, etc.

★ ★ ★

For further information see the nearest G-E Merchandise Distributor or write to Section D531-8, Appliance and Merchandise Department, General Electric Co., Bridgeport, Conn.

GENERAL ELECTRIC

EQUIPMENT NEWS

[FROM PAGE 96]

Emergency Lighting Unit

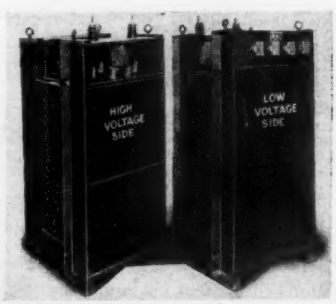
A new emergency lighting unit, known as Exide Lightguard, has been announced. It has been designed for use in war plants, arsenals, ordnance plants, shipyards and factories. It throws a beam of light 50 ft. wide a distance of 150 to 200 feet, covering an area of 7,500 sq.ft. Recharging is done automatically by trickle charge and state of charge is indicated by pilot balls. The unit measures overall 16½ in. long by 6½ in. wide by 18 in. high. The Electric Storage Battery Company, 19th Street and Alleghany Avenue, Philadelphia, Pa.

EXIDE LIGHTGUARD

■

Transformers

These new type air cooled transformers do not use liquids of any kind. They may be located anywhere indoors without building a protective vault. The entire line is constructed with class B heatproof insulation—fibre glass, mica, asbestos and porcelain. These transformers can be furnished up to 500 kva. in voltages to 4800 volts, single phase, three phase and Scott connected three to two or two to three phase in one unit. They are recommended for indoor installations in hospital, office, school, hotel buildings and in industry by aircraft manufacturers, ordnance plants, chemical plants, shipyards and any hazardous location. Eisler Engineering Co., 740 South 13th Street, Newark, N. J.



EISLER TRANSFORMER

UMI

More Gossip

New Address

Two electric shops in Lincoln, Nebraska, are now located in new quarters. The contracting firm of ABC Electric Co., formerly at 718 N. 35th St., and the motor service shop of J. O. Schon Electric Co., formerly at 219 N. 11th St. are now operating from 342 S. 11th Street. The new quarters are so arranged that both the motor service and contracting enterprises can be carried on independently.

Teaching in Air Corps

Eugene Anderson, vice-president, Anderson's Inc., Nashville, Tenn., motor service shop, is now in the U. S. Army Air Corps. "Gene", whose favorite pastime was constructing ingenious gadgets for his repair shop, is now sporting technical sergeant's stripes at Pendleton Field, Pendleton, Oregon.

His present assignment is teaching air corps gunners about the mysteries and intricacies of electrically controlled machine gun operation. That should be right in the groove for Gene is happiest when delving into the unusual.

Joins Navy Air Corps

James Taylor, president of the Taylor Electric Co., Milwaukee, Wis., has really gone all-out for Uncle Sam. Jim has joined up and is now an ensign in the Navy Air Corps. Previous to that he was working in the laboratory of the Square D Company and taking care of his own business after hours. Being an aviation enthusiast, he had a Stinson cabin monoplane which is now serving in the civil air patrol.

***MOTORS TO BROODERS** and anything electrical are repaired in the shop of the J. O. Schon Electric Co., Lincoln, Neb. Shop superintendent C. R. Caves is inspecting an electric chicken brooder that refused to operate.*

Patient Supervisor

"Jim" is a new supervisor in the repair shop of Sterling Electric Company, Lincoln, Nebraska. Jim is a carrier pigeon that John Bartlett, shop owner, befriended and nursed back to health. Now that he is well again, Jim has become so attached to his benefactor that he perches on John's shoulders patiently, but not always quietly, supervising shop operations.

Gets Results

H. A. Holden, H. A. Holden, Inc., Minneapolis, Minn., recently completed a whirlwind one-man drive to enlist members for the National Industrial Service Association. When he finally stopped to take a deep breath and tally his score, he came up with a grand total of 40 new members—almost 25 per cent of the total added to NISA during the past nine months. Apparently he has plenty on the ball.

***BETWEEN SESSIONS** at the NISA War Conference mid-west shop specialists Terry A. Bodine, Decatur, Ill.; W. H. Gruger (with stogie), Youngstown, Ohio; and D. L. Zimmerman, Wichita, Kansas, review the motor shop's place in war industry.*

Consolidates Operations

The Henry W. Miller Electrical Service of Omaha, Neb., has recently consolidated its various city offices and warehouses into a remodeled building at 415 South 18th Street in Omaha.

The city service department, heavy parts stockroom and garage occupy the first floor. The second floor is devoted to general offices, private offices, engineering department, small parts stockroom and repair departments.

The Miller organization is doing a considerable amount of electrical construction work on government projects throughout the mid-west. Henry W. Miller has three sons helping him in the business. Clifford is at Edmonton, Alberta on a construction project; Norman is supervising an army airport project at Liberal, Kansas; and Harold is working out of the home office.

All are kept on their toes, what with priorities, traveling, material delivery delays, and all the headaches that go with construction work today.

***WOMANPOWER** in the Electric Motor Repair Industry, a survey reported to the NISA War Conference by William Braunlich, Pittsburgh, Pa., revealed that 37 per cent of the shops reporting employed women for shop work.*

D.C. Contractors Name Officers

The Board of Directors of the Electrical Contractors Association of Washington, D. C., has announced the following officers elected for 1943; Lester K. Muller, president; F. J. Hoff, vice president; R. D. Porter, recording secretary and Carl S. Winkler, treasurer. Directors R. D. Porter, Jack Stone, Harry R. Mullen and L. K. Miller were re-elected to serve until 1946.

Contractors in the Navy

Two Twin City electrical contractors are now sporting uniforms of the U. S. Navy. Herb J. Wedding, proprietor of the American Electric Co., Minneapolis, Minn., enlisted in the U. S. Naval Reserve and left for training in Connecticut. Herb came up with a Chief Petty Officer's rating and his duties will be in connection with electrical shore installations.

Milton J. Smith, St. Paul electrical contractor, recently joined the Seabees (U. S. Naval Construction Battalion) and will help reconstruct and build naval bases to harass our enemies.

Chicago Lighting Institute Moves

War, of necessity, must disrupt many phases of our civilian life—even to dislodging us temporarily from our quarters. Those who have been accustomed to visiting the elaborate display of the Chicago Lighting Institute on the entire 36th floor of the Civic Opera Building, will now find the Army firmly entrenched there.

Since the Army has taken over these quarters, the exhibit has been dismantled. A large portion of it will be transferred, temporarily, to a section of the street floor Electric Shop of the Commonwealth Edison Company at 72 West Adams St., Chicago. Ample space for demonstration and meeting purposes will be provided and the activities of the Institute continued as usual.

In the News

ELECTRICAL MAINTENANCE at the Allison Engine Plant in Indianapolis is in the hands of Al Probst who is on his toes to keep electrical breakdowns to an absolute minimum.

WMC ORDERS JOB FREEZE

On April 17 Commissioner McNutt announced rules regulating the transfer of workers as follows:

904.1. Workers previously engaged in other than essential activities for work in essential activities. Any employer engaged in an essential activity may hire for work in such activity any new employe who for the preceding thirty days was not engaged in an essential activity.

904.2. Workers previously engaged in essential activities for work in other than essential activities. No employer shall hire for work in an activity other than an essential activity any new employe who, during the preceding thirty-day period, was engaged in an essential activity if the wage or salary rate to be paid by the employer would exceed the rate most recently earned by such employe.

904.3. Workers previously engaged in essential activities for work in other essential activities. No employer shall hire (except as provided for in Section 904.4 of this regulation) for work in an essential activity any new employe who, during the preceding thirty-day period, was engaged in an essential activity if the salary or wage rate to be paid by the employer would exceed the rate most recently received during such period by the employe.

904.4. Workers previously engaged in essential activities for work in other essential activities in areas or industries subject to War Manpower Commission employment stabilization programs. (A) Any employer engaged in an essential activity may hire for work in such activity any new employe who, during the preceding 30-day period, was engaged in an essential activity, without regard to his preceding wage rate or salary scale, providing such hiring is subject to, and permitted under an employment stabilization program approved by the War Manpower Commission.

(B) A statement of availability shall be issued to any worker by his last employer or by the War Manpower Commission as may be provided in such employment stabilization programs and whenever the worker:

(1) Is discharged by his last employer.

(2) Is laid off for an indefinite period or for a period of 7 or more days, or

(3) Can establish that his present employment does not utilize him at his highest skill or that he is not being employed at full time.

No statement of availability shall be issued solely on the ground that an individual's wage or salary rate is substantially less than that prevailing in the locality for the same or substantially similar work.

Any such statement shall contain the worker's name, his Social Security account number, if any, the name and address of the issuing employer or War Manpower Commission officer and office, the date of issuance, and a statement to the effect that the worker may be hired elsewhere in an essential activity. The inclusion by an employer on such notice of any information other than that required by this regulation shall be deemed to be a violation of this regulation.

904.5. Acceptance of employment by workers. No individual shall accept new employment with an employer if the employer is prohibited from hiring him under this regulation.

904.6. Penalties. The hiring by an employer of a new employe, or the acceptance by an individual of new employment, in violation of this regulation is subject to the penal provisions of the act of Oct. 2, 1942 (Pub. No. 729, the 77th Cong.). The provisions of Sect. 4001.10 of the regulations of the Economic Stabilization Director, issued Oct. 27, 1942, apply to any wages or salaries paid in violation.

NASHVILLE SHOP SPECIALISTS (L to R) N. G. Welsh, Electric Service, Inc.; A. F. Anderson, Anderson's Inc.; and H. E. Grant, Tennessee Electric Motor Service, bone up on the Controlled Materials Plan at the NISA War Conference in Cincinnati.

904.7. Definitions. (a) Essential activity means any activity in the War Manpower Commission list of essential activities and any activity approved by a regional manpower director as a locally needed activity.

(b) New employe means any individual who has not been in the employ of the hiring employer at any time during the preceding thirty-day period.

(c) New employment means employment with an employer by whom the individual has not been employed at any time during the thirty-day period preceding such employment.

904.8. Employe-employer agreements. Nothing in this regulation shall be construed to prejudice existing rights of an employe under any agreement with his employer.

904.9. Effective date. This regulation is effective as of April 18, 1943.

ALL-STEEL WIRING DEVICES

To conserve copper and copper base alloys used in the manufacture of electrical wiring devices, the War Production Board has issued Limitation Order L-277 which goes beyond Copper Conservation Order M-9-c by barring the use of these metals for the current-carrying parts covered by the regulation. Order M-9-c prohibited the use of such materials for non-current-carrying parts.

It is estimated that the annual saving of copper and copper base alloys under the new order will approximate 1,500,000 pounds.

The order also will serve another purpose. It provides a distribution control by restricting manufacturers' sales to orders rated A-1-j or better. Also, distributors will have to apply on PD-1X applications to replace supplies sold on unrated orders.

Substitute materials for copper and copper base alloys, such as carbon steel, are available according to WPB.

The use of steel will make no appreciable change in the quality or appearance of the various items, the Division points out, although copper products might last a little longer. In respect to safety, the use of steel in the parts designated has been

UMI

ONLY AN ELECTRICAL WHOLESALER COULD THUS SPEED WAR PRODUCTION

Burned down Friday—operating Monday

Wesco Rushed 11 Electrical Products; Saved 4 Weeks' Stoppage, Cut 49 Paper Operations

The four alarms brought all the fire apparatus but by Friday night the war plant making vital aluminum aircraft parts was a smoking ruin. The manager said—"We must be at work Monday morning" and phoned the local Wesco House. He specified immediate need of 11 electrical items including safety switches, motors and control, wire and cable.

During Saturday and Sunday Wesco delivered the complete order from stock as needed. Monday morning the workers stood under the open sky but the plant was humming. Only an Electrical Wholesaler could have done that job. For without Wesco this factory would have run up heavy phone bills in frantic appeals to 4 manufacturers, waited 30 days for complete delivery of products and piled up 60 costly clerical operations which Wesco preparedness reduced to 11.

This is one example from scores in which Wesco's 80 Branches are hastening Victory by helping speed war production. After the war these services and stocks will be again at the command of business and industry everywhere.

WESCO SPEEDS WAR PRODUCTION

* While building a large steel mill several electrical items from 6 different manufacturers were suddenly required. Delivery promises ranged from 60 days to 9 months. Wesco delivered all the items in 3 days and saved 74 paper transactions.
* Overnight delivery of hundreds of electrical products was required for a Marine air base. By pooling the stocks of 5 Wesco Houses all the items were on hand the next morning.

WESCO SERVES BUSINESS

* By assembling all parts of an order in one shipment.
* By buying large quantities at low prices and passing the savings on to small-quantity buyers.
* By extending credit to help finance jobs.

Westinghouse Electric Supply Co.

150 VARICK STREET • • • NEW YORK, N.Y.

A NATIONAL DISTRIBUTING ORGANIZATION WITH 80 BRANCHES

[FROM PAGE 100]

approved by the Underwriters Laboratories.

Under the order, "electrical wiring device" is defined as any unit of an electric circuit which does not consume electrical energy, but is used for the purpose of switching, tapping or connecting. Among the items included are:

Sockets and lampholders; switches, such as tumbler, push, rotary, snap, pull, door, pendant, cord, canopy and appliance switches; receptacles, such as weatherproof, watertight, non-watertight, motor base, polarized, locking, electric range and pilot light.

Also included are caps, plugs, connectors and taps, such as weatherproof, watertight, non-watertight, polarized, locking and electric range plugs, current taps, attachment plugs and rosettes and adapters. Component parts of the devices listed likewise are included in the order.

Exempt from the provisions are lighting fixtures, portable lamps, flashlights, fuses, fuse cutouts, lugs, mechanical wire connectors, knife blade switches, fluorescent starter switches, relays, push buttons, automatic control equipment or any unit of an electric circuit designed to connect, convey or control electrical energy in excess of 60 amperes or 600 volts. Some of these items are covered by orders already in effect.

The order also does not apply to electrical wiring devices or parts to be used in equipment designed for use in combat.

ILLINOIS INSPECTORS DISCUSS WAR DUTIES

Members of the Illinois Chapter, Western Section, International Association of Electrical Inspectors, met recently in Chicago for their 13th annual convention. The increased importance of the electrical inspector as a guardian of electrical safety; the growing problems resulting from more rigid materials restrictions; and cooperation between the various divisions of the electrical industry to meet such restrictions was the background of the session discussions.

James M. McConnell, Priorities District Office, WPB, Chicago, outlined the effects of WPB orders on the electrical industry. A. J. McGivern, Managing Director, Chicago Electrical Wholesalers Association, elaborated on this general theme, with specific emphasis on the wholesaler's limitations in supplying maintenance materials for civilian buildings. While wire, conduit and other raceways need a high rating, switches, fuses, sockets, and other similar items can be delivered for maintenance without a rating, he explained.

D. J. Talbot, acting chief electrical inspector, City of Chicago, explained the program his department has launched to clarify code conflicts under the new conduit limitation order L-225.

Experiments to determine practical blackout patterns were discussed by H. E. Wulfing, Commonwealth Edison Company, while John Harrington of the same company, exhibited some novel methods of exterior blackout control of store lighting. NEC interim amendments and emergency requirements were reviewed by V. H. Tousley, NFPA, while W. R. Rilling, Underwriters' Laboratories, Chicago, outlined the Lab's work on emergency wire and materials. Two Chicago inspectors, Newton Mosser and Roy Burgess, spoke on fluorescent lighting of industrial plants and inspectors' problems in general. Ed. Wigdahl, president, Cook County Electrical Contractors Association, led a round table discussion of electrical abuses.

At the business session, C. M. Park, Mill Mutual Fire Prevention Bureau, was elected president of the Chapter for 1943. New vice-presidents are Newton Mosser, L. E. Ewald and E. E. Dodge. P. J. Markey was re-elected chairman of the executive committee.

***ARTHUR C. ECKERMAN,** Personnel Supervisor, Wright Aeronautical Corp., explains the importance of giving aptitude tests to untrained applicants at the National War Conference of the Motor Repair Industry in Cincinnati.*

"No, no, Miss O'Malley, that isn't the kind of circuit breaker I meant!"

DESIGN AND MAINTENANCE FEATURED AT POWER CONFERENCE

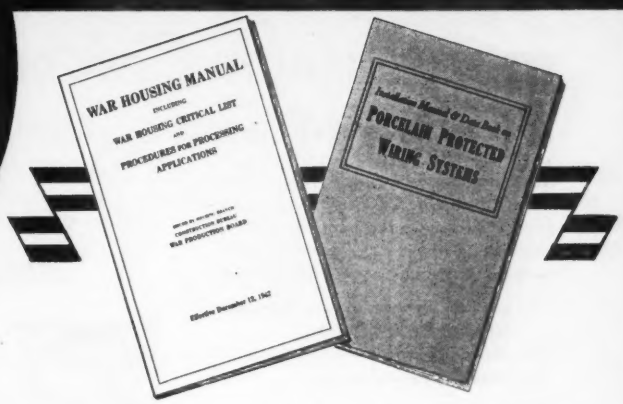
Power for Victory was the central theme around which sessions of the annual Midwest Power Conference revolved at Chicago's Palmer House April 8 and 9. Sponsored by the Illinois Institute of Technology and cooperating midwest universities and technical societies, the conference embraced some 10 sessions devoted to the design, maintenance and operation of power generation and distribution equipment.

Although the major portion of the program was devoted to the generation phase, two highly interested sessions covered the subject of electrical distribution—the problem most plant electrical engineers are facing. Thomas J. Higgins, Associate Professor of Electrical Engineering, Illinois Institute of Technology presented what is perhaps the first comprehensive paper on available literature covering low-voltage bus design. In addition to hitting the high lights of bus design factors, the paper included a bibliography of some 290 sources of material on this subject—a comprehensive guide for the person working in this field. Charles F. Wagner, Westinghouse Electric & Mfg. Co., discussed the application of shunt capacitors to existing power systems to meet emergency wartime demands. Dr. W. A. Lewis, Director, School of Electrical Engineering, Cornell University, outlined in detail the application of resonant grounding for long-

UMI

FOR WAR *Housing*

Modern PORCELAIN PROTECTED WIRING SYSTEMS



● The use of Porcelain Protected Wiring Systems for today's war housing is unrestricted. Non-metallic or porcelain outlet boxes, wiring devices, etc. are required by the War Housing Critical List and all other Government Directives on wiring construction.

In using Porcelain Products you save vital materials for war purposes yet, at the same time, you accomplish the following: 1. Complete installations in quickest time. 2. Do each job most economically. 3. Give the user a durable job so that he is assured of safety for the future. 4. Do a fully modern wiring job. 5. Assure liberal adequacy and capacity. 6. Insure against maintenance and trouble that is caused by rust and corrosion.

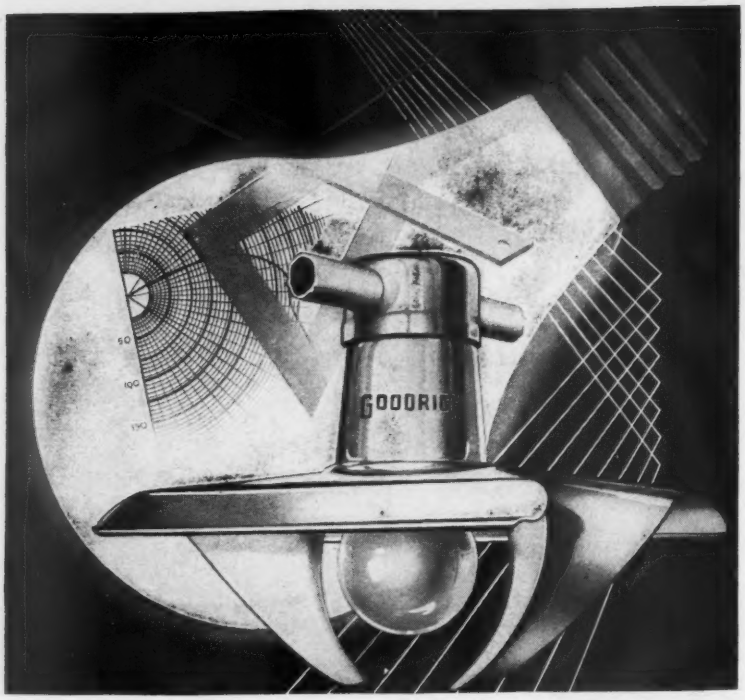
Such results as have been widely proved in these emergency times testify to the dependability and efficiency of Porcelain protected wiring. It is good reason why you should plan too on using this wiring construction for post war work. For details write to the companies listed below.

MODERN PORCELAIN PROTECTED WIRING SYSTEMS

★ ILLINOIS ELECTRIC PORCELAIN CO.
Macomb, Ill.

★ KNOX PORCELAIN CORPORATION
Knoxville, Tennessee

★ PORCELAIN PRODUCTS, INCORPORATED
Findlay, Ohio



WE "BENT" LIGHT IN *Eight* DIRECTIONS *to illuminate shelves and bins*

Stock bins and tool cribs were an "impossible" problem for illuminating engineers until Goodrich developed the Stocklite. This unique fixture now answers all three basic requirements by:

1. *Uniformly illuminating shelves from top to bottom row.*
2. *Making light reach into bin interiors.*
3. *Eliminating glare in the aisles.*

Nowhere else will you find such ingenious design — where many reflecting surfaces work together to build up light intensities where they are needed—using *all* the light without waste.

Today, the Stocklite is aiding America through faster, more accurate handling of stocks in hundreds of war plants, warehouses, and Government Departments. Ask for Bulletin 91.

Goodrich Stocklite —finished in permanent porcelain enamel.

RLM

Protecting vital plants with floodlighting — saving man-hours in production —Goodrich industrial fixtures are serving America's war effort everywhere.

LIGHTING FOR INDUSTRY

GOODRICH ELECTRIC COMPANY

OFFICES IN ALL PRINCIPAL CITIES

GENERAL OFFICES AND FACTORY: 4602 BELLE PLAINE AVENUE, CHICAGO, ILL.

SOLD ONLY THROUGH ELECTRICAL WHOLESALERS

In the News

[FROM PAGE 102]

distance power transmission systems.

The second distribution session was devoted to a summary of an A.I.E.E. paper entitled "A Proposed Wartime Guide for Industrial Power Applications". In presenting this summary, D. L. Beeman, General Electric Co., outlined the numerous factors affecting secondary distribution system design with particular emphasis on selection of equipment and choice of system to give economy, reliability, flexibility, safety, and at the same time conserve as much critical material as possible. Discussions of this paper by engineers in the utility and industrial field indicated the present trend toward simplification while still maintaining a necessary degree of reliability and flexibility.

A new feature of the conference was the addition of an Army Engineering Hour devoted exclusively to a discussion of power, lighting and heating design and maintenance at army cantonments. While discussing the fuel and heating problems at cantonments, Lt. Colonel Louis C. McCabe, revealed that the Army will use between 8 and 9 million tons of coal in the Fiscal Year 1944. J. A. Heffernan, Chief, Electrical Facilities Unit, Office Chief of Engineers, U. S. Army, while talking about power and lighting problems at army cantonments, pointed out that the army budget for the coming year provides for the maintenance of 18,000 miles of line (16,000 overhead and 2,000 underground) and that the energy requirements for army posts, camps and stations total more than 2,750,000,000 KWH.—roughly equal to that of the Boston and Washington metropolitan areas combined. Due to the tremendous amount of technological training troops must get, interior lighting represents over 50 percent of the connected load

***SPEEDY REPAIRS** in spite of spare parts delays are handled by John W. Bartlett of Sterling Electric Co., Lincoln, Neb. When stuck, John makes his own parts.*

UMI

Who else needs help at 35,000 feet?

AT FIRST GLANCE, you might think that *no one else* needs help to fly at high altitudes—once you've supplied the airplane's crew with oxygen masks and heated flying suits.

But, as Army and Navy Air Forces engineers found out a few years ago, *such is not the case.*

At high altitudes, as electrical engineers know, the electrical wire and cable in a plane need help too. It's now common knowledge that the distribution of electrical energy becomes more difficult to control as the air gets rarer.

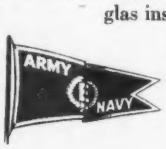
Today, the Army and Navy have an electrical insulation which resists the effects of corona at high altitudes. They got it by putting the problem up to the electrical industry. In solving this problem, electrical design engineers skillfully put Fiberglas to its best use by combining it with the newest improved impregnants.

Yet, these Fiberglas combinations have not only the virtues of . . . *high dielectric strength and high corona resistance.*

They are also *moisture-resistant . . . highly resistant to heat . . . unaffected by most acids.*

For all these good reasons, the aviation industry's demands for Fiberglas have been constantly growing with the fast-expanding output of planes.

The demands for Fiberglas-insulated motors and generators in planes have also greatly increased. In addition, the growing use of electrical equipment for Navy ships and many types of Army mechanized fighting and transport units has resulted in further demands for Fiberglas insulation.



To meet these demands, the production of Fiberglas was greatly increased last year . . . output is still being expanded every month, and will continue to be.

For both the electrical industry and Fiberglas are determined to do everything possible to make Fiberglas available for every vital wartime use.

• • •

Owens-Corning Fiberglas Corporation, Toledo, Ohio. In Canada, Fiberglas Canada, Ltd., Oshawa, Ontario.

FIBERGLAS* ELECTRICAL INSULATIONS

*T. M. Reg. U. S. Pat. Off.

. . that pint you gave

IT may be that many months may pass before the blood you gave will save a life . . . the place may be thousands of miles away.

The preparation of blood plasma is a meticulous process in which a special type centrifuge plays an important part. Centrifugal force, developed at enormous speed, with smooth acceleration, packs down the red cells and increases the yield of blood plasma. This calls for sturdy equipment, built for continuous duty.

The Ward Leonard Rheostat shown on this International Blood Plasma Centrifuge was selected as the motor control because of its dependability, its many accurate steps, and its electrical interlock which assures a slow start irrespective of when the switch is closed.

Ward Leonard Rheostats are available in a wide range of sizes for single and multi-mounting, manual or motor drive. Send for bulletins describing these and other type rheostats.

ARMY E NAVY

WARD LEONARD

RELAYS • RESISTORS • RHEOSTATS

Electric control (WL) devices since 1892.

WARD LEONARD ELECTRIC CO., 28 SOUTH ST., MOUNT VERNON, N. Y.

THERE ARE MEN IN OUR PLANT WHO WANT AN EGG IN THEIR BEER

As the outstanding manufacturers of home ventilators, Victor naturally has more than passing interest in tomorrow's home makers. One thing we know about these folks we can see right in our own plant, and we're convinced it's the same all over. It's the demand for something better—something extra.

One of the things the war has taught us all is a taste for the increased precision in manufacture that is reflected in finer products. When tomorrow's ventilation is ready, we promise it will please the folks who want an egg in their beer.

VICTOR ELECTRIC

The Quality Name in Things Electrical

VICTOR ELECTRIC PRODUCTS INC.

Dept. 1B-633 Robertson Rd., Cincinnati, O.

TOMORROW'S HOMES

For An Air Minded Nation . . . Victor Ventilation !

In the News

[FROM PAGE 104]

at the average army cantonment; power over 25 percent; cooking about 15 percent: outdoor street and protective lighting about 2 percent, he revealed.

The duties of the army engineers in wartime were outlined by Col. Charles Keller, District Engineer of the U. S. Engineer Office, Chicago. Col. Keller paid tribute to engineers, architects, and contractors who participated in work of the corps of engineers. He also read a message from Major General E. Reybold, Chief of Engineers, U. S. Army, calling for fighting engineers. "We want the young strong and fiercely willing men now being trained in every engineering college in the country. Send them into any engineer's office in the U. S. connected with our Division Engineer Organization. We will pass on their qualifications; we will provide them with a letter to their induction station earmarking them for the Army's Corps of Engineers. Give us engineers; we'll make 'em soldiers", General Reybold's statement read in part.

COMING MEETINGS

National Fire Protection Association—Palmer House, Chicago, Illinois, May 10–14.

National Electrical Wholesalers Association—War Conference, Statler Hotel, Buffalo, N. Y. May 23–26.

International Association of Electrical Inspectors—Western Section, 39th annual meeting, Chicago, Illinois, Sept. 13–15.

LIST IDLE EQUIPMENT

The War Production Board is doing its utmost to locate every idle electric motor and generator and get it back into active service. John Gammell, Chief of WPB's Electrical Equipment Branch, has called upon industry to cooperate with the Division by listing idle motors and making full use of its services in obtaining secondhand equipment.

"Failure to put idle equipment to work steps up the demand for new equipment and wastes manpower and plant facilities that are urgently needed for the war effort," Mr. Gammell said. "Steel, copper, aluminum and other critical materials are also wasted when new motors or generators are used instead of second hand ones that could adequately do the job."

Restrictions on purchase orders for new motors and generators imposed by General Conservation Order L-221 as amended January 15, Mr. Gammell pointed out, are designed to insure full use of second hand equipment. A purchase order for new motors or generators must have a preference rating of AA-5 or higher and the prospective buyer must certify that he has made every reasonable effort:

UMI

What the Trade has been Waiting for:

THE FIXTURE OF THE FUTURE!

THERE is nothing "ersatz" about the new Sylvania Fluorescent Fixture for industry. It is truly "the fixture of the future."

Sylvania engineers took up the WPB challenge to design a fixture without a metal reflector, with a top housing weighing less than 3 pounds.

In addition to complying with these official limitations, they took an important step forward. They designed a fluorescent fixture that will be as good years after Victory as it is today.

Watch for the announcement of "the fixture of the future" in this magazine next month. See how it makes fluorescent fixtures standard and flexible for the first time!

"Everything that's Finest in Fluorescent"

SYLVANIA ELECTRIC PRODUCTS INC.

Ipswich, Mass.

INCANDESCENT LAMPS, FLUORESCENT LAMPS, FIXTURES AND ACCESSORIES, RADIO TUBES, ELECTRONIC DEVICES

Ever Break a Socket?

To Avoid Troubles

hundreds of heavy industrials and shipyards are using our

UICO NO. 63310

IMPACT RESISTANT BAKELITE SOCKET

This All Canvas Bakelite Socket is built and proven to last three to four times as long as an ordinary socket. Such long-life dependability is especially essential now as it eliminates frequent reordering with accompanying priority problems and slow deliveries.

• *Write* for details today on No. 63310 Bakelite Socket.

THE ORIGINAL MANUFACTURERS of BAKELITE SOCKETS

UNION INSULATING CO.

Factory: Parkersburg, W. Va.
Sales Office: 27 Park Place
New York City

In the News

[FROM PAGE 106]

1. To adapt idle motors or generators in his possession to the purpose for which new ones are sought;
2. To obtain used equipment from other sources;
3. To repair or recondition his existing equipment.

"To assist industry in locating idle motors and generators," he stated, "the General Industrial Equipment Division has set up a Used Motor Unit in its Electrical Equipment Branch. The Unit has a file of about 30,000 used motors and generators including those listed by motor dealers with the OPA and those available in industrial plants. This file, which covers the entire country, is compiled from data received from the WPB field offices and directly from dealers and industrial plants and is kept currently up to date."

The Unit's chief function is to serve as a clearing house for owners and prospective buyers of idle motors and generators. Whenever possible, manufacturers looking for used equipment are referred to nearby sources of supply. However, the Unit's listing of equipment available in all parts of the country makes it possible to fill special needs even when idle motors and generators are not available locally. The Used Motor Unit also reviews a large percentage of applications for priority ratings on new equipment (PD-1A) and in many cases is able to give assistance in locating idle equipment. The Unit is under the direction of C. A. Sievert, former president of the National Industrial Service Association, who has had a long experience in the used motor field.

EMERGENCY REVISIONS OF N.Y.C. CODE

Patrick Quilty, Commissioner of the City of New York, Department of Water Supply, Gas, and Electricity, has issued three emergency war bulletins for guidance of inspectors and authorization for contractors to proceed under certain conditions.

Emergency War Bulletin No. 1 states: due to the scarcity of rubber, this department will approve for both ungrounded and grounded conductors, a new type of insulation for electrical wires and cables, known as "Emergency Insulation (Type E.I.)" for the period during which the scarcity of rubber exists, under the following conditions:

1. To be employed only for exposed open wiring on insulators.
2. Must be installed in accordance with the Electrical Code rulings pertaining to "open wiring" where they may apply.
3. For dry locations only.
4. Shall not be installed in damp or wet locations, nor on any hazardous locations, except where combustible fibers are stored or handled (but not in process of manufacture) and which are hazardous through the ignition of such fibers by arcing contacts,

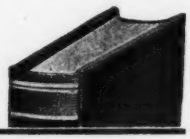
An easy-study guide to

Fundamentals of ELECTRICITY and standard methods of INDUSTRIAL WIRING

This book offers the practical worker a thorough training in electrical wiring for every industrial application. It not only gives standard, economical and efficient methods for doing every type of wiring, but also gives the groundwork in electrical theory, action and application of apparatus, principles of lighting, power circuits, etc., needed for the most intelligent and effective handling of this work.

Just Out!

NEW Second Edition



INDUSTRIAL ELECTRICITY AND WIRING

By James A. Moyer

Director of University Extension, Massachusetts Department of Education and

John F. Wostrel

Formerly Instructor in Electrical Engineering, and Supervisor in Charge of Industrial Subjects, Division of University Extension, Massachusetts Department of Education.

541 pages, 283 illustrations and diagrams, $2.75

The book will take anyone right from first steps through to the ability to handle industrial wiring intelligently and effectively by approved methods. Everything is clearly illustrated by diagrams, charts and tables, and the practice described throughout the book is based on the 1940 National Electrical Code.

NEW IN THIS EDITION

Chapter describing fluorescent lighting equipment.

Chapter showing various causes of radio set interference, including fluorescent lighting, and their remedies.

Practical Topics From the Book

Splicing and Soldering Wires
Calculation of Wiring Systems
Details of Wiring in Conduits and Moldings
Industrial and House Appliances
Electric Generators and Generator Wiring
Transformers and Connections
Residential Lighting Equipment
Outdoor Wiring
Distribution Systems
Circuit Control Apparatus
Etc, etc., etc.

10 DAYS' FREE EXAMINATION

McGRAW-HILL BOOK Co., Inc.
330 W. 42nd St., New York

Send me the Moyer & Wostrel's Industrial Electricity and Wiring for 10 days' examination on approval. In 10 days I will send $2.75, plus few cents postage, or return book postpaid. (We pay postage if you remit with order.)

Name .....
Address .....
City and State .....
Position .....
Company .....EC 5-43

This 48-page data manual published recently by the General Electric Company furnishes all of the information necessary for the design and installation of electrical systems in Robertson Q-Floors. The cellular structure of these modern Q-Floors makes possible electrical flexibility and adequacy undreamed of before—a definite advantage for building owners, architects and electrical contractors.

For further information about G-E Q-Floor Wiring and how it can be used to insure adequate electrical wiring, get in touch with your nearest G-E Merchandise Distributor.

★ ★ ★

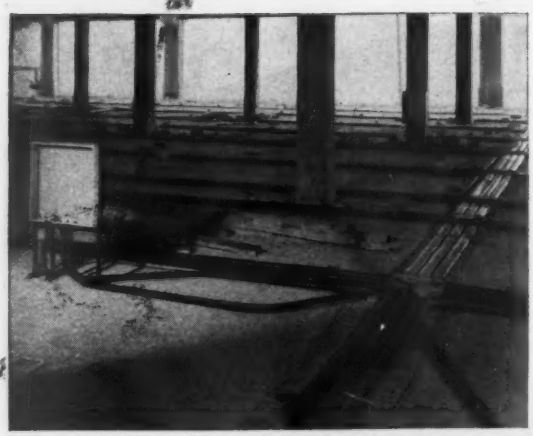
Q-Floor literature will be gladly furnished by Robertson engineers. Contact the nearest Robertson office (in all principal cities).

H. H. ROBERTSON COMPANY • Farmers Bank Building • Pittsburgh, Pa.

ROBERTSON Q-FLOORS

FOR UNDERFLOOR ELECTRICAL DISTRIBUTION

General Electric offers two types of underfloor wiring. Both give almost unbelievable flexibility to shops, factories, offices, etc. Electrical outlets can be added later as they are needed.



G-E Fiberduct installation.

Use G-E FIBERDUCT With Masonry and Wood Type Construction

Use G-E Q-FLOOR WIRING With Robertson Q-Floors

G-E Q-Floor Wiring installation.

Send the coupon for catalogs giving further information on these flexible underfloor wiring systems.

General Electric Company
Section C531-8
Appliance and Merchandise Department
Bridgeport, Conn.

Sirs: Please send me: ☐ The G-E Fiberduct Catalog ☐ The G-E Q-Floor Wiring Catalog

Name.....

Address.....

City..... State.....

GENERAL ELECTRIC

In the News

[FROM PAGE 108]

resistors, lamps or similar apparatus or appliances.

5. Where there are more than four conductors larger than No. 10 AWG., in an outlet or junction box, or in a cabinet or cutout box, the conductors must be individually wrapped with non-combustible insulating tape.

6. For voltages not exceeding 600 volts.

7. That the thickness of insulation be such that the over-all diameters will be comparable with those for Type "R" wires and cables of the same gauge.

8. That the wires and cables be marked with the manufacturer's name, or trade mark, and the type designation "E.I." along the entire length of the conductors so that they may be readily indentified in the field.

9. That all coils of wires and cables shall be plainly tagged or marked so as to indicate, and comply with the requirements of Chapter 30, Title B—40.0—al, 2, 4, 40.0-b and 41.0-b of the Administrative Code.

Emergency War Bulletin No. 2 states: due to the scarcity of rubber and copper, this department will approve the following substitute as a temporary departure from its requirements pertaining to the construction of "Pendant Weatherproof Lampholders" for the period during which the scarcity of rubber and copper exists:

1. In lieu of providing at least six (6) inch leads as part of weatherproof lampholders, which are intended to be exposed after the installation on mogul, medium, intermediate, candelabra and miniature-base sizes, the department will approve of such lamp-holders if provided with leads three (3) inches in length (measured outside of the body).

Emergency War Bulletin No. 3 states: due to the scarcity of rubber, this department will approve for grounded conductors the following emergency substitutions for the period during which the scarcity of rubber exists:

On alternating current wiring systems 0-600 volts employing a grounded neutral or a grounded conductor, known as the "identified" or "white" wire, slow-burning weatherproof insulated conductor (Type SBW), weatherproof insulated conductor (Type WP) emergency insulated conductor (Type EI), or other types of insulated conductors approved by the commissioner for this purpose may be used as the grounded neutral or a grounded conductor for mains, feeders, sub-feeders and branch circuit conductors up to the final outlet, but not including portable appliances or lighting fixtures, in any of the following wiring methods:

1. Open wiring installed on insulators
2. Armored cable
3. Rigid metal conduit
4. Flexible metal conduit
5. Electrical metallic tubing
6. Surface metal raceways
7. Underfloor raceways
8. Circular metal floor raceways.

UMI

LAST YEAR'S BONDS GOT US STARTED

THIS YEAR'S BONDS

ARE TO WIN!

★ Last year saw nearly 30,000,000 workers voluntarily buying War Bonds through some 175,000 Pay-Roll Savings Plans. And buying these War Bonds at an average rate of practically 10% of their gross pay!

This year we've got to top *all* these figures—and top them handsomely! For the swiftly accelerated purchase of War Bonds is one of the greatest services we can render to our country . . . and to our own sons . . . and our neighbors' sons. Through the mounting purchase of War Bonds we forge a more potent weapon of victory, and build stronger bulwarks for the preservation of the American way of life.

"But there's a Pay-Roll Savings Plan already running in my plant."

Sure, there is—but how long is it since *you've* done anything about it? These plans won't run without winding, any more than your watch! Check up on it today. If it doesn't show substantially more than 10% of your plant's pay-roll going into War Bonds, it needs winding!

And you're the man to wind it! Organize a vigorous drive. In just 6 days, a large airplane manufacturer increased his plant's showing from 35% of employees and 2½% of pay-roll, to 98% of employees and 12% of pay-roll. A large West Coast shipyard keeps participation jacked up to 14% of pay-roll! You can do as well, or better.

By so doing, you help your nation, you help your workers, and you also help yourself. In plant after plant, the successful working out of a Pay-Roll Savings Plan has given labor and management a common interest and a common goal. Company spirit soars. Minor misunderstandings and disputes head downward, and production swings up.

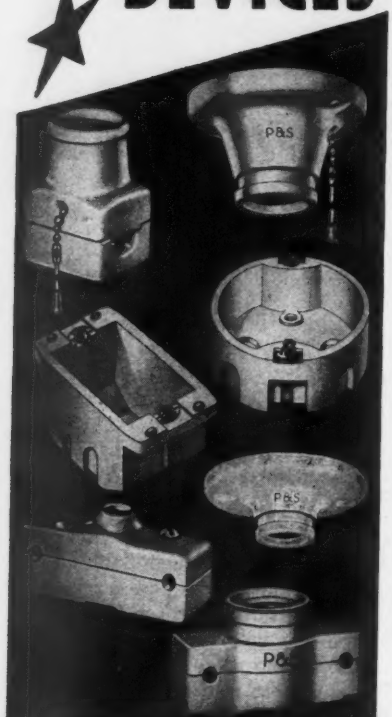
War Bonds will help us win the war, and help close the inflationary gap. And they won't stop working when victory comes! On the contrary—they will furnish a reservoir of purchasing power to help American business re-establish itself in the markets of peace. *Remember, the bond charts of today are the sales curves of tomorrow!*

You've done your bit Now do your best!

THIS SPACE IS A CONTRIBUTION TO AMERICA'S ALL-OUT WAR EFFORT BY

ELECTRICAL CONTRACTING

P&S
(time-tested)
PORCELAIN
Wiring
DEVICES



Just as P&S PORCELAIN WIRING DEVICES installed years ago are still serving faithfully—so new installations of these devices will serve long after this war is won.

Ask for complete information.

Sold through Electrical Wholesalers

PASS & SEYMOUR
INCORPORATED
SYRACUSE, N.Y.

In the News

[FROM PAGE 110]

STORAGE BATTERIES FOR FARM USE

New or rebuilt electric storage batteries of the type generally known as automotive replacement batteries, may now be bought by farmers for operating shocking devices for wire fencing and for use with other farm equipment.

Limitation Order L-180 as amended permits the purchase of electric storage batteries for farm uses formerly filled in whole or part by dry cell batteries which are no longer available. Approximately 765,000 storage batteries are needed immediately by farmers, according to the Production Equipment Division of the Department of Agriculture.

The original order considered replacement batteries only as automotive equipment, required the purchaser to turn in a used battery or to make certification about its disposal for scrap, and the use to which the newly purchased battery was to be put. Since farmers will use these batteries to replace dry cell batteries, or for new fencing or use with other farm equipment, they obviously cannot fulfill the requirements for turn-in.

To take care of this situation, the amended order provides that buyers may obtain new or rebuilt replacement batteries by signing a certificate supplied by the producer or distributor.

PACIFIC COAST BUREAUS MERGE

The wartime economy centralization program of the Northern California Electrical Bureau was recently completed with the merger of the Pacific Radio Institute with the Electrical Bureau. Last August, the Electric Appliance Society of Northern California officially joined the combination.

Operating under the Bureau name, the merged group will continue the activities formerly performed under the jurisdiction of the three separate organizations. This will be accomplished by providing for five sections on lighting, wiring, appliances, radio and education. Although wartime restrictions preclude any campaigns at present, the Bureau will be ready, when peace comes, to carry on bigger and more productive campaigns aimed at the enormous postwar need.

Local units will function as before and will expand their activities to represent the newly established five sections of the Bureau in their particular areas. Bureau headquarters are being maintained in the Western Furniture Exchange and Merchandise Mart.

The constitution and by-laws of the merged organization provide for a Board of Directors, an Executive Committee and five sections, each directed by a section

KNOW ELECTRICITY AS EXPERTS KNOW IT

—AND GET AN EXPERT'S PAY

What about your future? Who is safe today? Surely not the man who is contented to stand still! Know your job thoroughly—prepare yourself for jobs ahead. To do just this thousands of men have used

The CROFT Library of Practical Electricity

7 Volumes, 2906 pages
1948 how-to-do-it illustrations

● The Croft Library is a complete electrical educator. It is founded on practice—on 20 years of shirt-sleeve experience—on work as it is actually done. It is jammed from cover to cover with the kind of hardheaded facts you want. Written so that the beginner can easily understand it, yet so sound, so thorough, that it is the daily guide of 59,000 highly paid electrical workers and engineers.

● Croft tells you the things you need to know about motors, generators, armatures, commutators, transformers, circuits, switchboards, distribution systems—electrical machinery of every type—illumination in its every phase—the most improved methods of lighting—lamps and lamp effects, etc.—how to do a complete job, from planning it, to completion.

NO MONEY DOWN
EASY PAYMENTS
10 DAYS' FREE EXAMINATION

Fill in and mail the coupon below and we will send you the entire set of seven volumes for ten days examination on approval. We will take all the risk—you assume no obligation. If you decide to keep the books, send $3.00 in ten days and the balance at the rate of $3.00 a month.

SEND THE COUPON NOW
AND SEE THE BOOKS FOR YOURSELF

EXAMINATION COUPON

McGRAW-HILL BOOK CO.
330 W. 42nd St., New York

You may send me the seven volumes of the Croft Library of Practical Electricity for 10 days' examination. I agree to return the books, postpaid, in ten days or remit $3.00 then and $3.00 a month until the special price of $18.00 has been paid.

(To insure prompt shipment, write plainly and fill in all lines.)

Name .....

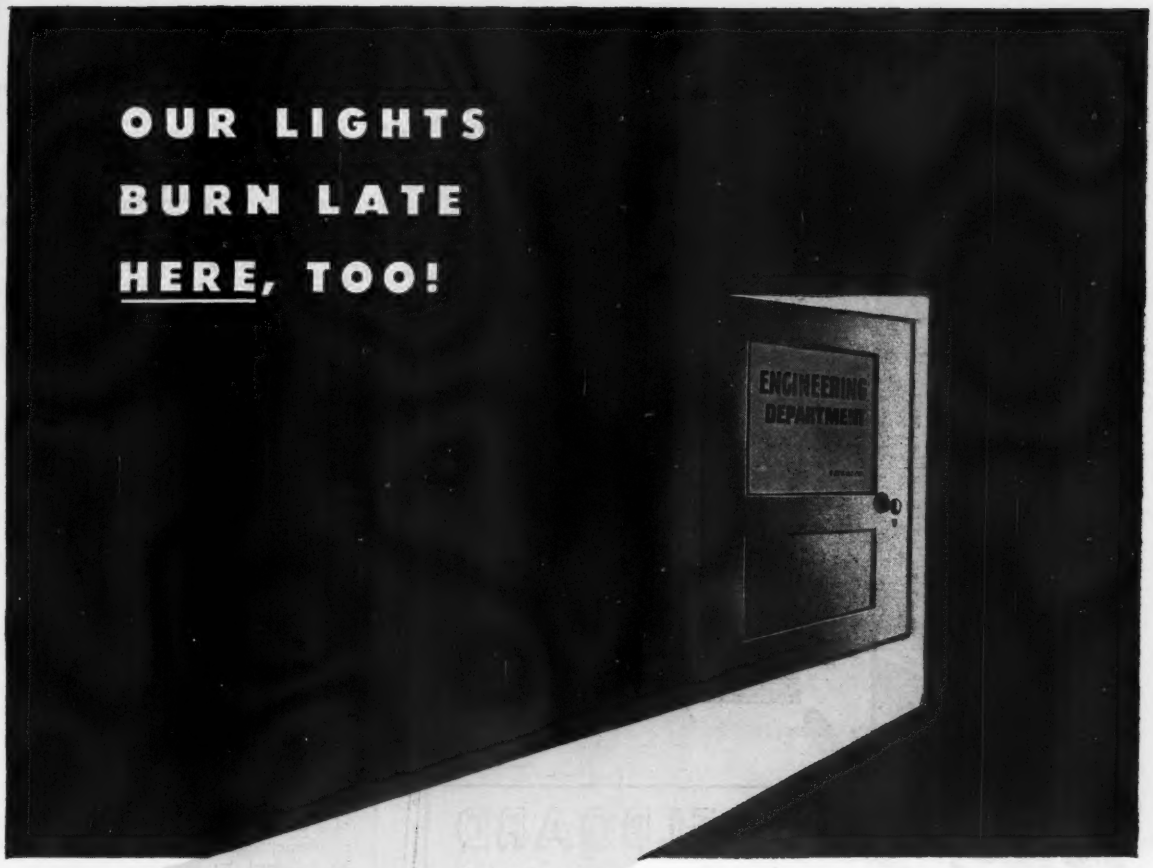
Home Address .....

City and State .....

Position .....

Name of Company .....E.C. 5-43

OUR LIGHTS BURN LATE HERE, TOO!



WAR'S grim needs keep our plants busy day and night, producing AmerTran Transformers, Reactors and Rectifiers. In our Engineering Department, also, the lights burn late these days. Here we are busy applying the principles we have learned in many years of transformer specialization, to the rigorous requirements of our armed forces. Much of the seed of this war-time development work will bear fruit later in the more fertile soil of a world at peace.

Some of our war research has resulted in pilot models that reveal new performance characteristics to meet the advances in the electronics and power fields. War's emphasis on economy and stamina under extreme load and climatic conditions has had its effect on our designs. Tests show losses lowered, efficiencies raised. Ease of installation has been stressed.

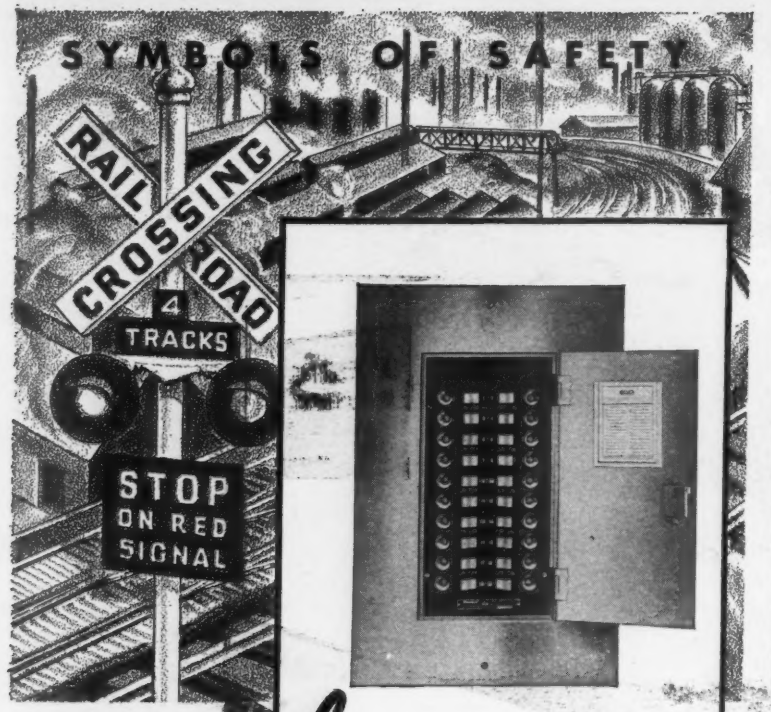
Today AmerTran Equipment goes to the Government and to customers with high priorities. Tomorrow we hope to serve again those good companies that cannot, for the time being, qualify in either of these categories.

AMERICAN TRANSFORMER COMPANY, 178 EMMET ST., NEWARK, N. J.

AMERTRAN

MANUFACTURING SINCE 1901 AT NEWARK, N. J.

PIONEER MANUFACTURER OF
TRANSFORMERS, REACTORS AND RECTIFIERS
FOR ELECTRONICS AND POWER TRANSMISSION



Federal PANELBOARD SAFETY FACTORS

INCREASE WAR PRODUCTION

Controlled, continuous lighting is essential for increased war production. That's why Federal panelboards are built with special safety features to insure perfect control and protection of lighting and small power circuits.

The rugged construction of Federal's low cost NTPR panelboards, for example, assures permanent alignment of working parts to reduce the danger of short circuiting. But there are many other safety features, such as—switch ahead of every fuse, floating contacts, large wiring gutters. This is true of *all* Federal Panelboards. Follow the leaders—for extra service and safety switch to Federal!

For Complete Panelboard Data

write for catalog 42. Contains all the essential facts on Federal NTPR and Mastertype panelboards.

FEDERAL ELECTRIC PRODUCTS COMPANY
48 PARIS STREET NEWARK, N. J.

PANELBOARDS • SWITCHBOARDS • SAFETY SWITCHES • CIRCUIT BREAKERS

In the News

[FROM PAGE 112]

chairman. Officers of the Bureau are: Louis J. Breuner, president; Chas. W. Goodwin, Jr., vice-president; Arthur E. Rowe, treasurer; O. R. Doerr, secretary and B. W. Reynolds, chairman of the Executive committee. Executive Committee Members include Mr. Reynolds, George W. Abbett, B. M. Tassie, A. H. Meyer, A. E. Rowe, George Tenney, Edward Duggan, Chas. W. Goodwin, Jr., and H. J. Newton.

Section Advisory Committee chairmen are: B. M. Tassie, Appliances; H. J. Newton, Wiring; A. E. Rowe, Radio; Edward J. Duggan, Lighting; and George Tenney, Education. The Board of Directors includes representatives of Manufacturers and Suppliers, Retailers, Broadcasters, Utilities and Members at Large covering other industry groups.

WATERMAN OF WPB ON WAR-TIME LIGHTING

Marshall N. Waterman, Assistant Director, Building Materials Division, appeared recently before a meeting of IES and E.M.E.A. of Pittsburgh for a discussion of "Choices in Wartime Lighting." He recommended seven principles that should be followed by designers, suppliers, and users of wartime lighting in order to assure conservation of critical materials. Mr. Waterman pointed out that critical materials in the instance of lighting not only involves metals, but it also includes man-power and man-hours used up in the maintenance of lighting systems or lost because of inadequate light. His seven points were as follows:

1. Use as a maximum design figure the minimum standards of the American Recommended Practice. Exercise a critical judgment as to the possibility of getting along, as well as possible for the duration, with foot-candle readings somewhat less than the minimum standards.
2. Rearrange the existing fixtures in an area to put the lighting to the most productive use.
3. Combine existing equipment with new to produce beneficial results. Thus, no large increase in critical materials is required.
4. Exercise good engineering judgment between a number of choices of installations with an eye on the amount of critical materials that will be required in light sources, fixtures, wiring, ladders, cat-walks, etc.
5. Consider the possible operation of the lighting system at higher voltages; for example, a series circuit of incandescent lamps, or fluorescent operation with the newly developed ballast arrangement, or the operation of sodium or mercury vapor lamps.
6. Consider the improvement of the contrast conditions with light-color paints on ceilings, walls, floors, and machines.

UMI

7. Maintenance problems and difficulties should be considered at the start of any design. Once a system is installed, it is important to the war effort to deliver the designed foot-candles at a high level at all times.

LIMIT CONDITIONS FOR USE OF TYPE EI WIRE

To further aid in the conservation of rubber, the electrical inspection department of the City of Chicago is permitting, for the duration, the installation of the new emergency Type EI conductors which substitute treated paper for rubber insulation. However, to safeguard life and property, there were very definite limitations placed upon the application of these cables.

As stated in a recent bulletin of the department, they are as follows:

1. Type EI wire may be used as ungrounded conductors for non-metallic sheathed cable run exposed and for open wiring on insulators under the following conditions:
   a. In dry locations only
   b. For potentials not exceeding 600 volts
   c. The conductors must be individually wrapped with a non-combustible insulating tape if more than four wires larger than No. 10 are in a cabinet or outlet, junction or cutout box.
2. Type EI conductors shall not be used in any hazardous locations except in storage compartments or sections of Class IV locations when code rules will apply.
3. For damp or wet locations, Type EIL conductors with emergency insulation and a lead covering may be used.
4. Type EI conductors cannot be fished in raceways.

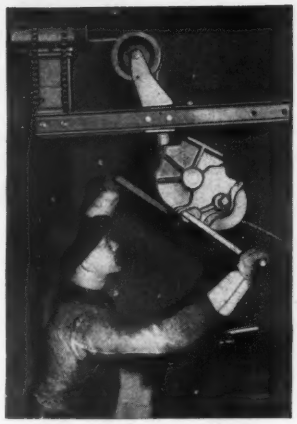
The electrical inspection department is requesting the cooperation of the electrical contractors in reporting the use of such materials and keeping records of such installations so any failures can be recorded. Special permits are issued for work involving the use of substitute materials limited to specific use, location and time.

LEAGUE LAUNCHES PLANT SERVICE GROUP

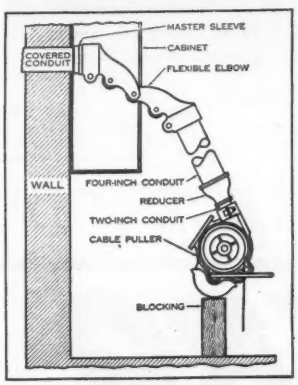
The first regular meeting of the newly organized Plant Service and Maintenance Division of the Electric League of Indianapolis, Inc., was recently held, following closely the highly successful electrical maintenance panel at the local WPB Production Clinic. Major plants of the city were represented at this initial meeting of the group by 125 plant engineers and maintenance superintendents.

Air Conditioning, the subject of the evening, was discussed by R. E. Von Spreckelsen, Lukas-Harold Corp.; D. G. Coates, Eli Lilly & Co., and R. Tutt of Allison Engineering Co. Each of these men is in direct charge of the system in his respective plant, hence first hand practical knowledge was presented on plant problems along these lines.

HERE'S HOW TO PULL CABLE WITH A GREENLEE CABLE PULLER



● Here's a fast, easy method of pulling cable that saves hours of work and does away with heavy, cumbersome equipment. There is no wear and tear on conduit hangers and the many difficulties experienced with make-shift methods are eliminated. A few of the many features of this versatile tool are outlined below.



PULLING FROM EXPOSED CONDUIT

The Puller is securely clamped directly on conduit for two important reasons. One . . . the conduit affords a convenient, positive anchorage. Two . . . by attaching the Puller to the conduit, a holding force is applied to the conduit itself, through the channel-iron frame . . . a force that is equal to the outward pull of the cable. This prevents loosening of hangers. Tension Drum is adjustable on beam and swivels in a full circle, providing clearance in close quarters. Puller will also operate on vertical conduit.

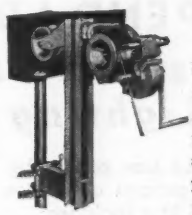
PULLING FROM CONCEALED CONDUIT

For concealed conduit, a flexible elbow attachment is used. One end, with a master sleeve, attaches to conduit and other end is attached to suitable length of 4″ pipe, which serves as an extension. Tension Drum is assembled at the end of extension pipe and supported with blocking. Roller guide spools direct the pulling force, and clamping sleeve exerts the holding force on conduit. There is no tendency for tool to rise upward in operation. Will also operate on vertical conduit.

OTHER SPECIFICATIONS

One man can operate, tool is portable, pays for itself on first few jobs. Has two-speed gearing — maximum pull 7500 pounds. Safety dog prevents unwinding. Cast parts semi-steel, cut steel gears, support frame — two 3″ channel irons. Net weights: Detachable Drum Unit — 85 pounds. Complete Tool (less Elbow Unit) — 170 pounds. Flexible Elbow Attachment (optional equipment)—approximately 65 pounds.

For complete details write for Catalog 33E. Stock is available for essential users.



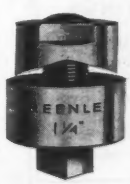
PULLING INTO JUNCTION BOX

Here the Puller is set up for pulling into a box from a vertical conduit. In this photo the tension drum is swivelled around from the position shown in the top picture. Special conduit adaptors are supplied for close quarters.

OTHER GREENLEE TOOLS SAVE HOURS OF WORK

BENDERS

For any bending job there's a Greenlee Bender. Small hand benders and powerful hydraulic benders for conduit, pipe and tubing from ¼ to 4½-inch size. They are easily operated by one man, save the cost of many manufactured bends, are easily carried to the job and set up.



KNOCKOUT TOOLS

Enlarge holes without long tedious drilling, reaming and filing with Greenlee Knockout Punches and Cutters. This handy tool is inserted in a knockout or a small drilled hole and a smooth accurate hole can be quickly cut by turning the drive nut with an ordinary wrench.

Greenlee TOOL CO.

1745 HERBERT AVE. • ROCKFORD, ILL.

WRITE FOR FREE COPY OF CATALOG 33E

A "SOUND" INVESTMENT IN PLANT PROTECTION

WITH the installation of a modern system of A.A.I. Automatic Alarms, industrial plants enjoy the greatest measure of protection from an ever threatening danger of sabotage, espionage and theft. By the ingenious use of tiny robot sentries, or detectors, attached at intervals along protective fence lines, the faintest of sound vibrations are instantly converted into both visible and audible signals to warn headquarters of danger and dispatch guards to the actual zone of disturbance. Here is dependable, round-the-clock, day and night protection, with fewer guards and greater security. Simple to install and maintain. Use Automatic Alarms to guard your particular properties and production.

Write for Literature

AUTOMATIC ALARMS

Licensed under DuPont and Astatic Patents

Incorporated

845 MARKET ST

YOUNGSTOWN, OHIO, U. S. A.

SALES OFFICES, Philadelphia, Chicago, Pittsburgh, Detroit, Tulsa, and Toronto, Canada

... SPERO

A DEPENDABLE SOURCE

For Industrial Electric Fittings and Lighting Equipment

Why waste time and lose orders by "shopping around"? Spero will back you up with prompt deliveries of quality electrical products—*priced right*. Spero line includes:

SPERO NOW MAKES NAVY 9S FITTINGS

To meet the demands for 9S Series fittings for the U. S. Navy, Spero now offers a complete line of steel drawn boxes—in 3", 4" and 5" sizes, manufactured according to Navy drawings.

- Fluorescent Lighting Fixtures
- Shallow and Dome Type Reflectors
- Flood Light Fixtures and Equipment
- Vapor-proof Lighting Units
- Surface Cabinets
- Industrial Installation Equipment

Distributed only through legitimate electrical wholesalers

THE SPERO ELECTRIC CORPORATION

18222 LANKEN AVE. ★ CLEVELAND, OHIO

In the News

[FROM PAGE 115]

Maintenance Department Organization is the topic scheduled for the next meeting and again men from local plants will contribute their personal knowledge and experience on the "how to" phase of the subject. This will include discussions of inspection schedules, job responsibilities under changing shifts, supervision and maintenance records.

Membership in the new group consists of the industrial plants themselves. Latest additions to the roster include: Allison Engineering, Davis Cleaners, Electric Steel Castings; Indianapolis Bleaching Co.; International Machine Tool Corp.; and the Lukas-Harold Corp.

INCANDESCENT FIXTURE REGULATION

WPB has issued Limitation Order L-212 in a move to channel all incandescent lighting fixtures into war work or defense housing and other essential civilian uses, and to conserve critical materials.

It is estimated that the order will result in the saving of from 2,500 to 3,000 tons of ferrous metal this year. This saving will be effected in various ways.

First, the amount of metal permitted in the manufacture of standard utility and industrial incandescent lighting fixtures is reduced about 60 percent.

Second, the amount of metal permitted in residential type fixtures is reduced about 80 percent.

Third, certain simplifications and a reduction in the number of sizes and shapes permitted to be produced are ordered.

The new regulation restricts the sale of industrial and utility lighting fixtures to orders carrying a preference rating of A-1-j or better. However, sales of fixtures made of materials acquired prior to the date of the order are not restricted.

No restrictions are placed on partly fabricated fixtures, or on fixtures now in inventories held by dealers and jobbers. It was felt that most of such fixtures were not essential to the war program, being odd pieces or discontinued types.

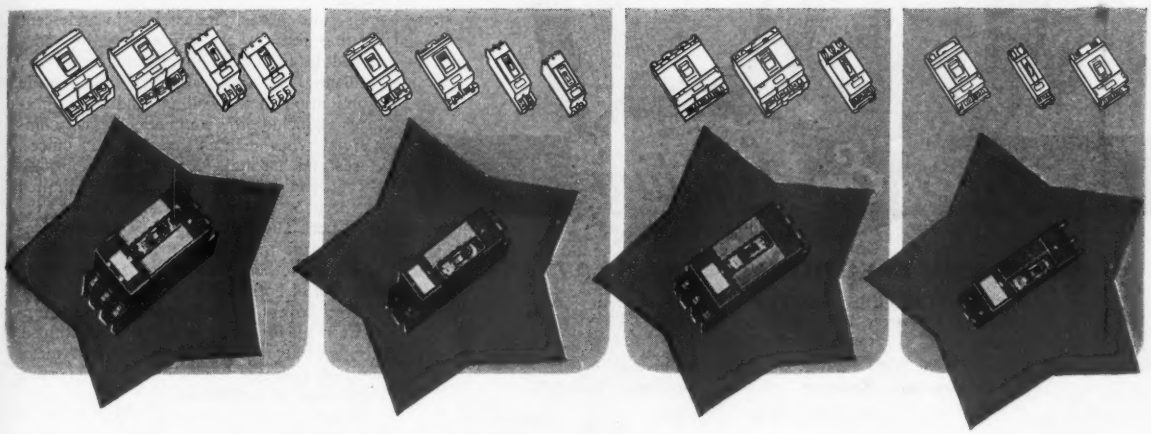
The most drastic cut in the use of ferrous metal is the limiting of residential fixture manufacturers to the use of only six ounces of metal per fixture. This amount is sufficient, however, to permit glass, vitreous porcelain and other nonmetallic materials used in making residential type fixtures to be attached to electrical outlets or building structure.

Some manufacturers already have developed residential fixtures using slightly less than six ounces of ferrous metal and have incorporated in the fixture both eye appeal and efficiency, as well as maintaining good lighting standards in their products.

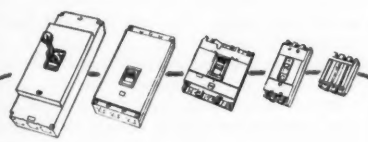
Unlike industrial and utility lighting fixtures, the residential fixtures will not re-

mobilized FOR WAR

4 breakers
TAKE THE PLACE OF 14



——TO SAVE 18% COPPER
——TO SAVE 38% STEEL
——TO CONSERVE SPACE
——TO IMPROVE CIRCUIT PROTECTION



Nofuze "De-ion" Breakers

—prevent *harmless* overloads from interrupting war production.

—protect circuits from *dangerous* overloads and "shorts."

—restore service *instantly* with just a flip of the switch.

As a voluntary war measure, Westinghouse has "mobilized" the Nofuze line of "De-ion" Breakers. For example, all ratings from 15 to 100 amperes have been made available in one compact frame size. Instead of 14 models, 4 now serve the same purpose. Pole spacing and terminal arrangements have been made standard for interchangeability. Space is saved—vital materials are conserved.

Today, the production of Nofuze Breakers is concentrated on war requirements. Our engineering facilities are serving all branches of the war effort on a broad consulting basis.

Result: many far-reaching developments are being made . . . overload protection of low-voltage circuits has been greatly improved. If you have a war circuit problem, ask your Westinghouse representative for engineering help. Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa., Dept. 7-N. J-60523

Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

NOFUZE CIRCUIT PROTECTION

BEST FOR ELECTRICAL INSTALLATIONS

LLOYD STARTERS hold first place for efficiency and long life wherever 100-watt lamps are used. They have longer life . . . start more surely more times.

FS-6 NB Master No-Blink (2-prong)
FS-6 (2-prong) Regular FS-64 (4-prong) Regular

Lloyd Policy Insures Quality

LLOYD PRODUCTS COMPANY

Dep't. EC-5 Providence, R. I.
Representatives—Branch Offices—Warehouse Stocks in 23 Leading Cities

PIPE BENDER

for steel pipe and conduit from ⅜" to 4½"

PATENTS and PATENTS PEND.

- NO HEATING
- NO FILLING
- NO KINKS
- NO WRINKLES

Make your offsets and bends up to 90° (and more) in one single, simple operation in a few minutes.

The pipe is NOT MOVED during the bending thus avoiding kinks and wrinkles. All bends—one or 1000 all identical and perfectly uniform even if made by "green hands."

Quick changeover to various sizes. Few seconds to mount and dismount. FASTEST PORTABLE BENDER!

SMOOTHNESS OF BENDS:

No wrinkles—no kinks—no breaking of pipe due to scientific development of bending formers. No job too complicated.

Obtainable in three different sizes
Meets U. S. Navy, Army & Maritime Comm. Specifications
Write today for circular giving complete description

TAL'S PRESTAL BENDER, INC.

Dept. E5 Milwaukee, Wisconsin

In the News

[FROM PAGE 116]

quire a prlority rating to be purchased. Residential fixture manufacturers will be allotted raw materials under the Controlled Materials Plan to manufacture a sufficient number of fixtures for the defense housing plan and for the most essential civilian needs.

In the order, industrial incandescent lighting fixtures are defined as those designed to illuminate manufacturing areas; residential as those designed to provide illumination in a dwelling, and utility fixtures to include the commonly known commercial types such as those used in offices, stores and hospitals.

Industrial lighting fixtures will be limited to three basic types: the shadeholder, the solid neck and the heavy duty thereby prohibiting the manufacture of some eighteen or twenty other types which are relatively wasteful of both metal and man-hours. Use of steel covers for industrial lighting equipment made of glass is to be discontinued. Use of louvers, shields, baffles and metal indirect reflector bowls for utility lighting equipment is forbidden.

The Lighting and Fixture Section, Building Materials Division, WPB, is studying means to further standardize and simplify the permissible types and sizes of fixtures and further to reduce the metal gages. The Section also is making a study of materials which may be substituted for metal in the manufacture of industrial and commercial fixtures, including such materials as fibers, paper products, non-critical plastics and glass. Various fiber and paper products as well as specially treated glass show some promise in this respect, according to the Section officials. At this time, however, only a relatively few possibilities in substitutes for steel have been developed.

DETROITERS GET REFRESHER COURSE

School days are back again for the members of The Electrical Association of Detroit, this time in the form of a refresher course on the fundamentals of electricity. Evening classes are being held in the auditorium of the Detroit Edison Service Building on March 24; April 7, 21; and May 5 and 19.

Classes are open to everyone in the electrical business who is a member of the Association or is sponsored by a member. There is no charge or registration fee for this course which will serve a dual purpose—as a refresher for those who already have had the fundamentals and a basic course for those in the non-technical end of the business who may want a better understanding of electricity and its potentialities.

Subjects covered in the course include Ohm's Law; Fundamentals of Wiring; Reading Blueprints; Power Distribution Systems; Permit and Inspection Require-

ments; Apparatus Control; and How to Make an Estimate. Leading off the first instruction-discussion was Professor H. O. Warner, Director of Electrical Engineering, University of Detroit, who spoke on "What is Electricity." The other subjects are being presented by experts in each particular field.

In offering the school, the Association hopes to lay the ground work for additional classes in the fall designed to give an extended, detailed coverage of all fields of electricity that are of value to the members.

INDIANAPOLIS LEAGUE OFFICERS CHOSEN

All officers of the Electric League of Indianapolis, Inc., were re-elected for the 1943 term at a recent meeting of that organization. Dan C. Hess was chosen to head the organization again as president; C. H. Domhoff as vice-president; H. W. Claffey, secretary; C. F. Fitchey, assistant secretary; Ben Olsen, treasurer; and Wm. J. Morgan, assistant treasurer.

Members of the Board of Directors include: C. H. Domhoff, Appliance Dealers Division; Paul Loser, Appliance Distributors; H. W. Claffey, Contractors; G. E. Hunt, Manufacturers; Louis Jonas, Motor Repair; R. H. Wilson, Oil Heating; H. J. Kreutzinger, Plant Service and Maintenance; John Urban, Supply Jobbers; and A. C. Crandall, Utilities. Walter O. Zervas is managing director of the organization.

FARMS GET MORE POWER

Thirty-two Rural Electrification Administration projects stopped by the War Production Board on July 21, 1942, have been re-examined in the light of current farm needs for power and will be completed as rapidly as possible.

The deciding factors in favor of reinstating the projects, Mr. Nelson said, were that they will permit electric service to 6,700 farms when completed.

The projects now average 71 percent complete, he said, varying individually from 50 to 89 percent completion. Approximately $1,800,000 had been invested in them up to the time work was halted and expenditure of another $800,000 will complete all 32 projects. The construction involved will total 2,861.2 miles of line.

Each project bears an endorsement from the local Department of Agriculture War Boards and analysis of the farms to be served reveals a material increase in critical food production will result.

The principal critical materials needed to complete the projects, Mr. Nelson, said, are 1,000 tons of steel wire, 560 tons of copperweld cable and 80 tons of weatherproof copper wire. All of this except 750 tons of steel wire either is on hand or is obtainable from frozen stocks or excess inventory. From a practical standpoint, no other use exists for these frozen stocks comparable to the benefits to be obtained

It takes TOOLS to win the war

Don't abuse them!

KLEIN TOOLS EST. 1857

Since 1857

ONE of the indications of a good workman is the way he cares for tools. Today, with the Army and Navy demanding quality tools in unheard-of quantities, there are few that can be spared for civilian needs. It is doubly important then that we make every tool we use give its full measure of service.

Most tools do not wear out. They are broken, damaged or lost long before they serve their full life. Conserving tools will add months, even years to their usefulness.

As a contribution to this tool-conservation program, we have prepared a booklet packed with suggestions on the care and safe use of tools. A copy of this booklet will be sent to anyone interested.

Handle tools carefully—treat them well. Quality tools are built to stand hard use—not abuse. Remember that a broken tool is a "break" for Hitler.

DISTRIBUTED THROUGH JOBBERS

Foreign Distributors:

International Standard Electric Corp., New York

Write for this free booklet on the care and safe use of tools.

Mathias Klein & Sons
3200 Belmont Avenue, Chicago, Illinois
Gentlemen: Please send me without charge a copy of the booklet *"Long Life to Tools."*

Name.....

Address.....

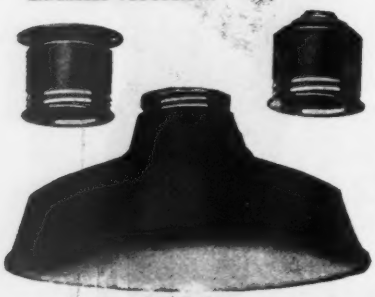
City.....*State*.....

Mathias KLEIN & Sons
Established 1857 — Chicago, Ill. U.S.A.
3200 BELMONT AVENUE, CHICAGO

MANUFACTURERS OF LINEMEN'S AND ELECTRICIAN'S TOOLS AND EQUIPMENT

ADJUSTABLE PORCELAIN ENAMELED FLOODLIGHT

QUAD LIGHTING UNITS



No. 1184-M
RLM THREADED DOME REFLECTOR

● The QUAD line offers you the finest in Industrial Lighting Equipment for those important victory manufacturing installations. The demands for additional lighting in plants increases daily and QUAD units—RLM and other porcelain enameled units—will fill indoor and outdoor needs perfectly.

QUADS . . . for today and for tomorrow!

QUADRANGLE MFG. COMPANY

Mfgrs. of Incandescent and Fluorescent Lighting Equipment

32 SO. PEORIA ST. CHICAGO, ILL.

If you are looking for **DEPENDABILITY** IN SEVEREST **CONTACTOR DUTY**

Get Zenith Catalog giving simple constant-service construction of NEW

ZENITH Magnetic Contactor

For use as motor starters, blackout switches, emergency controls, X-ray contactors, many other purposes. Withstand heavy surge of Type C lamps. Electrically held. All parts instantly accessible. *Most silent Contactor made.* A.C. hum practically eliminated. 30 to 400 amps., A.C. & D.C.

CATALOG Shows Full Line

Zenith Automatic Control Equipment: Switches, Timers, Program Clocks. *Control Equipment for Special Jobs.* Wire or write

ZENITH ELECTRIC CO.

155 W. Walton St. Chicago, Ill.

DRILL HOLES
Up to 1¼" Diam.
In Masonry & Concrete
ANY Depth

By Welding Extra Shank Here →

PAINE
"Sudden Depth"
DRILL BITS
CARBOLOY TIPPED →

● This new feature increases the flexibility and use of this drill bit that makes holes 50 to 75% faster and lasts surprisingly longer. It is quiet in operation. Can be used in any rotary drill (slow speed). Available in sizes from 3/16" through 1¼" diameter (graduated in 1/16" sizes). All have maximum ½" shank.

Ask your Supplier NOW and Write for Catalog.

THE PAINE CO.
2961 CARROLL AVE., CHICAGO, ILLINOIS
Offices in Principal Cities

PAINE FASTENING and HANGING DEVICES

In the News

[FROM PAGE 119]

from completing the electrifiction of these farms.

"While this action does not represent a lessening of the critical situation in the metals field", Mr. Nelson explained, "it does represent a decision to make the best possible use of materials on hand."

MOTOR SCHEDULING BECOMING CRITICAL

Plans for the scheduling of purchase orders for electric motors and generators were discussed in detail at a recent meeting in Washington of the Electric Motor Industry Advisory Committee with the War Production Board and other Government officials.

The Committee considered a scheduling form which was submitted by WPB's General Industrial Equipment Division and recommended that only the most critical types of motors and generators be scheduled at the present time. The critical types mentioned include some d.c. motors and generators and a few types of a.c. motors.

FAN REPAIR PARTS

Users of portable electric fans are assured of the maintenance of such equipment, insofar as service depends upon the supply of repair and replacement parts, through provisions of General Limitation Order No. L-176. This includes both domestic and commercial electric fans. Manufacturing of certain repair and replacement parts on a limited basis is provided for in the revised order, easing previous restrictions.

Definition of "Electric Fan" in L-176 has been expanded to include the wall type propeller fan having a blade diameter of less than 17 inches, and any ceiling fan. Provisions of the order now apply to these types as well as to portable electric fans.

Production of electric fans has been limited to marine types for shipboard use since September 5, 1942. At the same time, sales of all fans in manufacturers' hands were prohibited except upon specific authorization of WPB.

In lieu of a supply of new fans, L-176 recognizes the essentiality of maintaining existing equipment. In addition to the permitted manufacture of fan blades and electric motors, the order now also permits the use of copper and copper base alloys in the production of parts which conduct electric current. These same metals may also be used in bearings, if no other material is practicable. The manufacturer must restrict production of all parts so that his inventory does not exceed the total number of parts of each type that he had sold during the preceding six months.

Previously, only steel parts could be manufactured, prior to yesterday's revisions, production of those parts containing copper or copper base alloys was prohibited except on individual repair jobs calling for not more than two pounds of such metals.

No manufacturer or distributor may deliver a new part unless a similar used part is given to him in exchange, or unless the used part is being held by the distributor or dealer.

In effect, the person who has his fan repaired does so on an exchange basis. The dealer accepts the used part, which he has replaced with a new one in the repair job, and holds it at the disposition of his distributor or manufacturer. If used parts are not called in within 60 days, the holder must dispose of them through regular scrap channels.

RECONDITION YOUR FILES

Indicating that conservation of 600 tons of high carbon steel and substantial saving of manhours can probably be attained through widespread application of "hand file reconditioning", the Conservation Division is encouraging war plants to investigate the practice for their own use.

For checking on industry's reaction to the use of reconditioned files, questionnaires were sent by the Tools Division to a number of leading aviation, ordnance and industrial plants. The answers indicate that this procedure adds about 60 percent to the original life of the file and the cost of reprocessing is only from one-half to one-third the cost of a new file. Deliveries of reprocessed files were generally reported to be more prompt than deliveries of new files.

The resharpening procedure is not new. In normal times, when the availability of manhours of labor and the supply of steel were not factors, there was not as great a demand for this reprocessing technique. However, the direct contribution of this wartime measure to the conservation program as a whole, plus the added incentive of reduced operating expenses derived from this practice, has resulted in a sharp increase in the use of reconditioned files.

LEAGUE SETS WARTIME OBJECTIVES

Electrical leagues can play a vital part in the organization of wartime activities of the various phases of the electrical industry. With promotional activities curtailed for the duration they are directing their energies along the service front.

Following this trend of thought, the Board of Directors of the Electrical League of Indianapolis, Inc., adopted the following five point program for the coming year:

1. Assist War Effort
   a. Assemble and disseminate information on Priorities and Govt. regulations.

TIME-SAVING FEATURES OF J-M TRANSITE DUCTS--NO. 4

CREWS like to work with Transite Ducts, because these modern cableways are supplied in long, light lengths that make handling easy and rapid. The assembly method is so simple that even unskilled crews can do fast work. No screwing or threading is needed. Lining up is fast and accurate.

And, on the job, these asbestos-cement ducts won't rot, can't burn, effectively resist corrosion, help assure permanently low maintenance costs.

For details, write for brochure DS-410. Johns-Manville, 22 East 40th Street, New York, N. Y.

FREEDOM FROM ELECTROLYSIS, plus high resistance to soil corrosion, mean that Transite Ducts keep upkeep low.

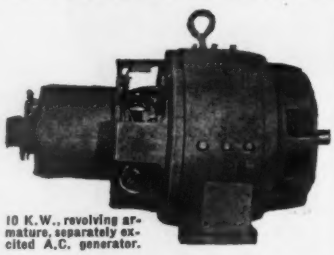
JM Johns-Manville

TRANSITE DUCTS

TRANSITE CONDUIT . . . for exposed work and for installation underground without concrete encasement.

TRANSITE KORDUCT . . . for installation in concrete. Thinner-walled, lower-priced, otherwise identical with Transite Conduit.

110-VOLTS A. C.
ANYTIME, ANYWHERE WITH
KATOLIGHT
GENERATORS AND POWER PLANTS



10 K.W., revolving armature, separately excited A.C. generator.

Furnish same kind of current as city power lines for operating standard A.C. portable electric tools, transmitters, receivers, floodlights, etc.

Good deliveries on A.C. generators, 350 through 15,000 watts. Available in all standard voltages 110, 220, single phase, 2 or 3 wire, three phase or three phase four wire. Frequencies 25, 30 or 50 cycle on specification.

Kato's entire production at present must be confined to orders with high priorities.

Also manufacturers of a complete line of rotary converters

KATO ENGINEERING
530 Front St. Mankato, Minn.

MOTOR-START
Capacitors

● It's easy to service electric refrigerators with Aerovox motor-starting capacitor replacements. An up-to-date listing tells you what exact-duplicate or universal type to use for every standard type of motor. And the local Aerovox jobber stocks them for your convenience. See him. Or write us.

AEROVOX CORPORATION
NEW BEDFORD, MASS., U. S. A.
In Canada: AEROVOX CANADA LTD., Hamilton, Ont.
EXPORT: 100 Varick St., N. Y., Cable 'ARLAB'

In the News [FROM PAGE 121]

   b. Help to locate critical materials.
   c. Stress preventive maintenance for continuous production.
   d. Aid service and repair agencies.
   e. Assist with salvage and conservation.
2. Extend Consumer Services
   a. Resurvey existing repair facilities.
   b. Publish directory of retail and wholesale service outlets.
   c. Assist in training service men.
   d. Develop cooperative exchange for pooling parts and tools.
   e. Inform public on care and repair of home appliances.
3. Retain Essential Industry Services
   a. Gather data on development of markets to absorb post-war production.
   b. Work toward maintaining existing system of distribution.
   c. Provide general meetings to keep members abreast with conditions and activities.
   d. Continue bulletin service.
4. Foster Public Relations
   a. Cooperate with civic and trade bodies.
5. Post-War Planning
   a. Serve as vehicle through which plans of national planning bodies can be organized for local support.
   b. Participate in local industry and civic planning activities.

This statement of policy is designed to serve as a guide to the Development Committee and to the various Divisions of the League in setting up specific programs.

SALVAGE DEFECTIVE LIGHTING EQUIPMENT

Replacement of defective or burned out ballasts and transformers was discussed from the standpoint of salvaging and reusing such equipment wherever possible. The discussion took place in meetings of the Lighting Fixture Ballast and Transformer Committee and of the Fluorescent Lighting Fixture Industry Advisory Committee. The manufacturers reported that a considerable proportion of ballasts and transformers returned to them are not actually defective. They report also that a certain number which are defective can be restored to serviceability. Emphasis was made on the desirability of having ballasts or transformers returned to the source from which they were obtained in connection with any orders for replacements. All members of the lighting fixture industry should do what they can to educate users or distributors to see that ballasts and transformers are returned in every case of failure where replacement will be made.

The committee also discussed a tentative simplification program which would reduce the number of sizes and types of hot cathode ballasts and cold cathode trans-

How to save time by doing more reading

That is a profitable paradox for you. More true today than perhaps ever before. For here in the pages of this publication are packed many helpful ideas . . . considerable useful information. Much of it, in fact, available from no other source.

And we most emphatically mean *both* the editorial and the advertising pages.

Just one new idea gleaned from these pages . . . a method for doing something better or faster or easier or at lower cost, may alone save you far more than a year's reading-hours invested in this and other worthwhile business papers.

Many people have found this a fact . . . not only once, but time and time again. That's significant . . . with time so precious today.

★

Good advertising speeds information from those who have it . . . to those who need it.

■

McGraw-Hill Publishing Company, Inc.
330 West 42nd Street New York

formers for the purpose of saving critical materials, warehouse and distribution time and expense. Another topic was the reduction to a minimum of the losses in fixture wire due to the snipping off of short lengths when ballasts are assembled into fluorescent lighting fixtures. It was suggested that discussion be held by the ballast makers and lighting fixture manufacturers to see whether it would be possible to standardize the length of ballast leads to achieve a minimum waste of wire.

At the Fluorescent Lighting Fixture meeting a report was made to the committee on steps taken by the War Production Board to obtain up-to-date and detailed information on remaining inventories of non-industrial or so-called commercial fluorescent fixtures which have been "blocked" in inventory since June 2, 1942. The Lighting and Fixtures Section emphasized that the inventory information will be used in efforts to direct prospective purchasers to this inventory. Instructions have been issued to War Production Board Construction groups that lighting fixture requirements for offices and similar areas in new building projects be taken from the fixture inventory wherever fluorescent lighting fixtures are approved. A list of names and addresses of holders of "blocked inventory" of non-industrial fluorescent fixtures is being prepared for placement in WPB field offices where it may be used for reference by prospective purchasers of lighting equipment.

In a discussion of the L-78 order as amended January 26, considerable time was spent on the "interchange" clauses which permit, under certain conditions, the sale of fluorescent lighting fixtures from one fixture manufacturer, wholesaler, or retailer to other manufacturers, wholesalers, or retailers without a preference rating. The advantages and disadvantages of such permissible interchange was discussed and resulted in indication by the Lighting and Fixtures Section that these clauses will be studied with the thought that improvements and changes may be necessary.

The continuing restriction against the manufacture of non-industrial fixtures types was discussed in its relation to the remaining inventory of such fixtures already fabricated.

In answer to a request from industry members for clarification of paragraph (4), the Building Materials Division explains that this paragraph does not prevent the manufacture of fixtures employing one lamp or four or more lamps. The Division explains further that paragraph (4) will not interfere with any special authorizations for manufacture of non-industrial fixtures pursuant to paragraph (b) (1) (i) (*a*) as now written.

HOTEL REPAIR AND CONSTRUCTION

A clarification of present War Production Board restrictions and orders governing construction, alterations, and maintenance and repair work, as applied specifically to hotels, has been issued by the Service Equipment Division.

Wherever they're Burning "Midnight Oil"...

Adequate, dependable lighting keeps working morale high.

Wherever the lamps carry the Champion Diamond mark a major share of the responsibility for faithful, economical performance is off your shoulders.

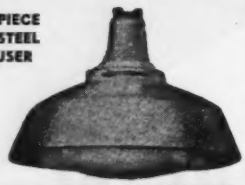
Remember the four points of the Diamond:

1. **Champion Quality** — backed by forty-three years of specialization and a guarantee to equal or exceed Federal Specifications.
2. **Champion Service** — stocks for essential needs and trained lamp men in the field.
3. **Champion Economy** — lower light and lamp costs than those of any other lamp of equal quality.
4. **Champion Distribution** — through qualified industrial suppliers equipped to meet emergency needs efficiently and economically.

GET THIS handy manual containing practical, usable helps and suggestions on industrial lighting use and care. Write for Champion Manual A giving your name, company, position.

CHAMPION LAMP WORKS
Lynn, Massachusetts
A DIVISION OF CONSOLIDATED ELECTRIC LAMP CO.

TWO PIECE GLASSTEEL DIFFUSER



MULTI

Reflectors

INDUSTRIAL REFLECTOR

EVERY WAR PLANT NEEDS THEM

. . . they need the high lighting efficiency—the good appearance—the lower lighting costs. MULTI Incandescent Reflectors require only to be inspected at regular intervals to insure getting the very best out of them. They'll keep the wheels turning for war production.

Send for complete catalog.

MULTI

ELECTRICAL MANUFACTURING CO.

1840 W. 14th St., CHICAGO, ILL.

ILSCO

Electrical Connectors

Write Your Own Ticket

Ilsco APPROVED SINGLE HOLE SOLDERING LUGS

Because all lugs are drawn from large seamless copper tubes right in our own plant we can furnish

SOLDERING LUGS ANY SIZE, TYPE, SHAPE OR PURPOSE

ILSCO facilities help you solve your problems . . . ILSCO quality assures you of best results always . . . all ways.

MAIL THIS COUPON TODAY

Please rush us sample and 32-page illustrated catalog.

NAME .....

FIRM NAME.....

ADDRESS .....

ILSCO COPPER TUBE & PRODUCTS, Inc.

CINCINNATI, OHIO

In the News

[FROM PAGE 123]

Hotels contemplating construction or alterations should obtain copies of WPB Order L-41, as amended February 19, 1943. Important changes are:

1. As before, the terms of paragraph (b) (1), which prohibits unauthorized construction, do not apply to hotels, provided the estimated cost of the construction over any continuous twelve-month period does not exceed $1,000. The revised order, however, further provides that within the prescribed limit of expenditure, not only materials obtained without priorities assistance may be used, but also materials obtained with priorities assistance for some other purposes before construction was begun, subject, of course, to restrictions of any other orders applicable to such materials and to Order L-41.

2. A recent amendment to Conservation Order L-41 specifically provides that where a single job is partly maintenance and repair and partly new construction, the whole project will be considered new construction and subject to L-41. Under the new definition, maintenance and repair means the work that is necessary to keep a structure in sound condition, but does not include any building operation involving a structural alteration or change in design.

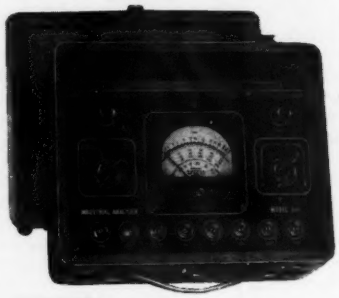
3. Minimum construction necessary to make safe and to protect any structure project (or the contents thereof) damaged by fire or other specified casualty may be undertaken without application, provided it can be completed without priority assistance for the materials involved.

4. Construction to rebuild or restore multiple residential construction (hotels) damaged by fire or other specified casualty may be undertaken or new multi-residential construction may be built in its place, provided, however that the estimated cost of reconstruction, restoration or new construction shall be less than $5,000 and that within two weeks of such damage or destruction Form PD-200 is filed with WPB.

Hotel purchasing agents should promptly secure a copy of CMP Regulation No. 5. This regulation provides an A-10 rating to hotels for necessary maintenance and

WOMEN TAKE OVER the winding department at Schneider Electrical Works, Omaha, Neb. Girl at right, a veteran of 5 years experience, finds various motor connections interesting.

THE NEW MODEL 560 INDUSTRIAL ANALYZER



MEASURES

A.C. CURRENT—UP TO 30 AMPERES

A.C. AND D.C. VOLTS—UP TO 1500 VOLTS

RESISTANCES—UP TO 2500 OHMS

★ Completely portable—operates on self-contained 1½ Volt standard dry cell—no external source of current required.

★ All calibrations printed directly on meter—no computations or charts.

★ Same scale used for both A.C. and D.C. Voltage measurements.

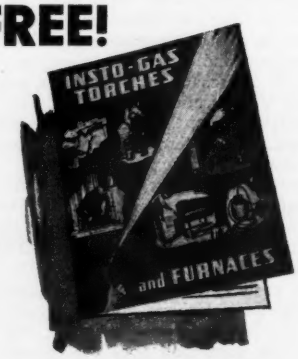
★ Resistances as low as 1/10th of an ohm and Voltages as low as 1 Volt can be easily read.

MODEL 560 comes housed in hand-rubbed wooden cabinet complete with portable cover, self-contained battery, test leads and instructions. Size 8½" x 7" x 4¼"; Shipping weight 7 pounds. Net Price..... $28.50

SUPERIOR INSTRUMENTS CO.

Dept. C, 227 Fulton Street, New York, New York

FREE!



Illustrated Bulletin on

INSTO-GAS TORCHES AND FURNACES

Here is the latest information on the fast, safe, economical Insto-gas Torches and furnaces that are being used on all kinds of electrical construction, maintenance, and war production jobs. Now is the time to modernize your portable heat equipment.

——USE THIS COUPON——

INSTO-GAS CORPORATION,
1900 E. Jefferson, Detroit

Please send me Insto-gas Bulletin, Free

Name .....

Address .....

What do you do when a motor quits?

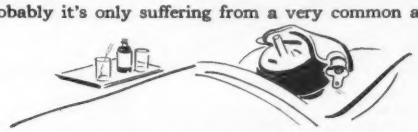
Well, frankly, you're in a jam.

You should, of course, take care of motors *before* they quit, by giving them the *little* maintenance so necessary to keep them on the job.

For example, let's consider Small Motors . . . those tiny, work-til-they-drop fellows who run your pumps, fans, appliances, and so forth. How long has it been since you gave them a little care?

It's so easy to keep your Small Motors in A-1 shape, happy at their job. Just be on the alert for their common enemies . . . friction, dust, moisture, vibration, overheating, noise.

If your Small Motor is already suffering from "ill-motor health", diagnose the symptoms and get it running again. Probably it's only suffering from a very common ailment.



We have just prepared a new Small Motor Maintenance booklet. It tells you how to protect your motors from their enemies, what to do when they attack. This new booklet is so chock-full of sound information that you will value it from the very moment you receive it.

For example, what would you do if your Small Motor failed to start? There are 13 possible "reasons why" and this new booklet tells what to do about each. You'll find it easy to understand; profusely illustrated; complete with maintenance details.

Keep those Small Motors on the job—our country needs them! Let us send a free copy of this booklet for each maintenance man in your factory or shop. No obligation. Just tell us how many you need. Ask for B-3215. Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa., Dept. 7-N.

J-90473

3 Reasons Why We Must Make Electrical Equipment Last Longer

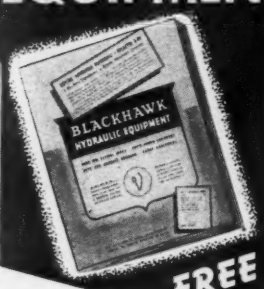
The more we save critical materials and the faster we produce, the sooner these birds will get it in the neck. Here's a book that's a real help. It's the new 100-page Westinghouse "Wartime Conservation" Book. Full of wartime information, it contains recommendations to save critical materials when selecting, applying, or using electrical apparatus. Write (company letterhead, please) for your copy. Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., Dept. 7-N.

Westinghouse

PLANTS IN 25 CITIES... OFFICES EVERYWHERE

small motors

Just Published! To Help
SPEED WAR WORK
Clip the coupon for your copy of the NEW bulletin on
BLACKHAWK HYDRAULIC EQUIPMENT



FREE

Get the story on these amazing Porto-Power PIPE BENDERS
They have exclusive features that put money in your pocket and rush projects way ahead of schedule. And, with your man-power and material problems — you'll be glad to know that they're ONE-MAN OPERATED and ACTUALLY SAVE MATERIALS!

IF YOU ALREADY OWN A BLACKHAWK PIPE BENDER — all the more reason to write for the new Bulletin. We want you to have the benefit of knowing all about the special attachments which adapt *your present* hydraulic unit to pulling drive pulleys, lifting heavy equipment into place and doing scores of other trouble jobs easily!

Mail This Today

BLACKHAWK MFG. CO.
Dept. M2053, Milwaukee, Wisconsin
Rush your new Hydraulic Equipment Bulletin V-43 to us.

Name.....
Company.....
Address.....
City and State.....

In the News

[FROM PAGE 124]

repair of facilities or for necessary operating supplies. The preference rating assigned by this regulation shall supersede the preference rating assigned by all orders in the P series except as may be otherwise provided by amendments of such orders specifically providing to the contrary. Hotel operators are urged to check within a few weeks to determine whether amendments have been made to the following orders for which they probably have occasional use: P-84 for plumbing repairs; P-126 for refrigeration; P-130 for internal telephone communication.

Hotel engineers should be familiar with Order M-208 which gives a rating to lumber to be used for repair and maintenance.

Priorities

BUS DUCT TYPES LIMITED

A substantial saving in the use of steel and copper in the manufacture of busway or bus duct will be affected as a result of General Limitation Order L-273. By definition in the order busway, or bus duct, is an assembly of copper bus bars in an enclosing case or framework, used either as a secondary feeder to transmit electric power or as plug-in type to provide a flexible electrical distribution system for industrial plants.

Busway, as manufactured prior to the new order, had copper conductors based on an amperage rating of 1000 amperes per square inch, and utilized a case which, for the most part, required considerably more steel than necessary. L-273 restricts the manufacture of busway to specific amounts of copper and maximum weights of steel which may be used for each of the ampere ratings permitted under the order; and these quantities of steel and copper have been reduced to a minimum consistent with adequate performance.

Plug-in busway is limited to three ampere ratings with the largest being 600 amperes and feeder sizes are permitted throughout the entire range of ratings to and including the 2000 ampere size, with larger ratings permitted only on special authorization. The ampere ratings which have been chosen and which the manufacturer is permitted to build are carefully selected to coordinate them with other electrical equipment in a secondary distribution system. In addition to this, each manufacturer is specifically limited to the number of types he may make for each amperage rating, and changes from his standard construction are not permitted for the normal installation.

L-273 covers only the common types of prefabricated plug-in and feeder type bus-

ELECTRICAL SPECIALTIES
FOR HEAVY INDUSTRIAL SERVICE
RMC

One of the many various types of RUSGREEN Endulators. Also End Bells for use with steel or fibre conduit. D.C. service or non-ferrous metal.

RUSGREEN Bus Supports . . . made for indoor or outdoor service. All types and constructions.

For more than a quarter of a century, RUSGREEN has specialized in the manufacture of Standard and special electrical items for heavy industrial applications. All are built to the most exacting requirements . . . assurance that they'll do the job. Write for a complete selection of RUSGREEN bulletins.

ENDULATORS (POTHEADS) ALL SIZES • ALL SHAPES • ALL VOLTAGES • ALL TYPES • BUS SUPPORTS • SPLICING KITS AND MATERIALS • INSULATING COMPOUNDS
★ ★ ★
RUSGREEN MFG. CO.
14260 Birwood Avenue • Detroit, Mich.

Order a
PARAGON
TIMER Today

"Time Delay Relay"

If you need a Timer . . . order it from Paragon and early shipment will be made . . . provided, of course, you furnish the necessary priority rating. Even though Paragon is manufacturing extensive electrical equipment for the armed forces, it is making and shipping Time Control devices every day.

Timers are being used for more different applications today than ever. Send for a complete catalog today.

PARAGON ELECTRIC COMPANY
401 South Dearborn Street, Chicago, Ill.

Paragon Chicago
BUILDERS OF ELECTRICAL EQUIPMENT SINCE 1903

UMI

New "MITCHELITE" Line of Fluorescent Fixtures

Introduced to Comply with Latest WPB Requirements Effective May 5th

Easier, More Economical to Install and Maintain

NOW you can do a better lighting job than ever before . . . at less cost. Amazing new design and construction make MITCHELITE units easier to install and service—insure superior lighting performance . . . save time, money and manpower. Wide range of accessories provide for every conceivable method of mounting or hanging, to fit every lighting situation in factory, office or drafting room.

MITCHELITE units are cooler operating . . . have new type wireway channel . . . are lighter in weight . . . have famous Lumenite non-metal reflectors with remarkably high reflection factor . . . meet all latest requirements of WPB and U. S. Bureau of Standards . . . are Underwriters' Laboratories and E. T. L. Fleur-o-lier Approved throughout.

All this makes MITCHELITE the world's finest industrial lighting fixture line. Available in four models . . . each model so flexible it can be used for both individual and continuous row mounting . . . 2-light Model No. 2075 and 3-light Model No. 2076 using 40-watt lamps . . . 2-light Model No. 2077 using 100-watt lamps . . . and a 2-section Model No. 2078 for four 100-watt lamps, which operates with only one ballast.

GET NEW FREE CATALOG NO. 400

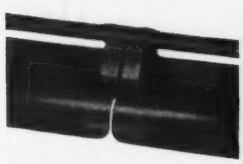
New illustrated MITCHELITE Catalog gives complete details...shows mounting methods. Get your free copy now from your MITCHELL DISTRIBUTOR, or write to

MITCHELL Manufacturing Company
2525 North Clybourn Avenue ★ Chicago, Illinois

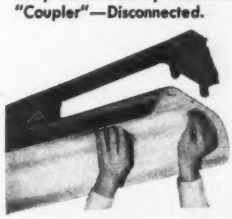
Each MITCHELITE Model can be used for both Individual and Continuous Row Lighting

Units Easily Joined End-to-End in Continuous Rows—for Surface or Suspension Mounting.

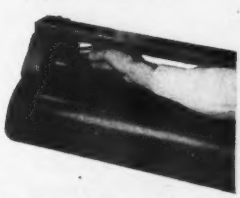
Easy-fit Wireway Channel "Coupler"—Disconnected.



Easy-fit Wireway Channel "Coupler"—Connected.



Reflector Quickly Released by a Few Turns of Wing Nuts.



Starters Easily Accessible Without Disturbing Lamps.

Showing Wireway Opening for Lead-in.

MITCHELL FLUORESCENT

So you think you know all sources of supply?

The 1943 E-B-R (Electrical Buyers Reference) contains 592 pages, entirely devoted to the electrical market-place. Between its covers are packed 369 pages of BRIEFALOGS* covering 290 manufacturers — a Directory of Manufacturers (classified by products) containing 153 pages — a Company and Trade Name Index of 45 pages. It lists thousands of companies and products. Among these thousands are many new manufacturers, new products, substitute materials, added lines. *Not* among them are manufacturers who may be out of business, products no longer being made. E-B-R works a sizeable staff of specialists who do nothing else but keep this data up to date for you. Today it literally lays the electrical marketplace in your lap. Use it — today and every day.

** E-B-R's own original version of modern condensed cataloging.*

IF IT'S ELECTRICAL ... LOOK IT UP FIRST IN E-B-R

Now more complete than ever before, your 1943 Electrical Buyers Reference gives you:

MANUFACTURERS BRIEFALOG SECTION — Condensed catalogs of 290 manufacturers. Product specifications, branch offices, warehouses, etc.

CLASSIFIED DIRECTORY — Company addresses and trade names, arranged by product. Extensive cross-references to help you find the electrical and allied products made by more than 3,500 manufacturers.

INDEX OF TRADE & COMPANY NAMES — Complete with addresses. Starting with only a trade name or a company name, you can thus quickly locate the product data you need.

A WORD OF EXPLANATION — E-B-R is not sold, and is not offered as a premium for subscriptions to any magazine. It is distributed to a limited number of men directly responsible for the specifying or requisitioning of substantial amounts of electrical materials.

McGRAW-HILL PUBLISHING COMPANY, 330 W. 42nd ST., NEW YORK, N. Y.

way, and does not include any type using rolling trolleys, or the so-called "step-type" busway.

Under the provisions of the order, no busway may be ordered or delivered on a preference rating below AA-5, after April 5, and busway not complying with the steel and copper provisions of the order may not be ordered after April 5, or delivered after May 24.

UTILITY CONNECTIONS TO FARMS

Electric service is brought within reach of smaller farms under an amendment to Utilities Order U-1-c. The action is designed to increase food production on such farms by making it possible to operate farm machinery with electricity, saving manpower and increasing production.

Previously a minimum of ten "animal units" was required to make a farm eligible for electric service. An "animal unit" is a measure of a farm's productive capacity. Under the amended order the minimum is cut to five animal units. An extension of up to 100 feet is permitted for each animal unit, if all other conditions of the order are satisfied.

The Office of War Utilities also released to utilities the material in electric lines not now in service, to be used in building the short extensions permitted by U-1-c.

CONSTRUCTION LESS THAN $10,000

A simple plan has been offered by WPB for the allotment of controlled materials under CMP for certain types of construction costing less than $10,000.

WPB recently empowered Regional Offices to authorize the beginning of agricultural and many types of commercial construction costing less than $10,000. Agricultural construction covered by the procedure includes barns, silos, and other farm buildings, while commercial construction includes such buildings as stores, garages, laundries, office buildings, warehouses, and similar structures.

No application to a claimant agency for allotment of controlled materials is necessary for construction of this type. Under the procedure now set up, a simplified PD-200-c form applicable to these cases will be used. This form requires submission of a materials list.

The materials proposed to be used are listed, and the forms are filed with the War Production Board District Office. The forms then go to Regional Offices which make allotment of controlled materials and assign preference ratings on CMP-L-127 forms. Attached to this form

Trailing Cables FOR Vital WAR Work

TIREX - rubber sheathed - cables were designed for hard, rough work. They still have remarkable wearing qualities and abrasion resistance and can be depended upon for continuous, dependable performance but, for the duration of the war, they meet restrictions governing the use of rubber, copper and other scarce materials.

It is important, now more than ever before, to get maximum service from trailing cables upon which portable or mobile electrical equipment depends for current. New cables are hard to get and those already in service must be used until they are completely worn out. To this end we make four suggestions.

1. As far as possible use the proper size and type of cable for the work to be done.
2. Inspect cables frequently and regularly to discover conditions that may cause trouble.
3. Provide extra protection or change location where exposure is hazardous.
4. Make repairs promptly when needed.

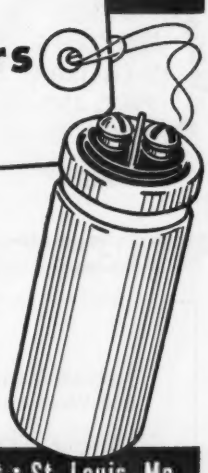
If you must have new cables for vital war work we shall be pleased to do all we can, consistent with conservation restrictions, to help you get what you need.

Simplex WIRES and CABLES

Simplex Wire & Cable Co., 79 Sidney Street, Cambridge, Mass.

For Repairing Refrigerator Motors

Get Genuine Mallory Capacitors from I W I



You will soon need a supply of capacitors for those "hurry-up" jobs on refrigerators. We have anticipated your needs by putting in a stock of all popular sizes.

When you need capacititors for refrigerator or other electric motors, order genuine Mallory Capacitors from I. W. I. Any of these offices will be glad to serve you.

INSULATION AND WIRES, Inc. — 2127 Pine Street · St. Louis, Mo.

INSULATION AND WIRES, INC.
2127 Pine St., St. Louis, Mo.

INSULATION AND WIRES, INC.
30 Trowbridge Ave., Detroit, Mich.

INSULATION AND WIRES, INC.
181 Portland St., Cambridge, Mass.

INSULATION AND WIRES, INC.
289 Simpson St., N. W., Atlanta, Ga.

H. A. HOLDEN CO.
318 Fourth Ave., So., Minneapolis, Minn.

W. C. JOHNSON
309 Kellogg Ave., Peoria, Ill.

TRI STATE SUPPLY CO.
544 So. San Pedro, Los Angeles, Calif.

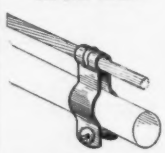
ROBERT McKEOWN COMPANY
249 High St., Newark, N. J.

MINERALLAC

New Practical Unit to Cut Installation Time

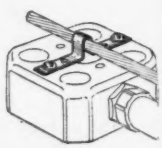
● The "Messenger Hanger" and the "Messenger Strap" fill the need for an economical, practical, time-saving unit for use with the new messenger cable type of installation. Mechanically strong, durable, lightweight. They have considerable material and are easily and quickly installed. Our bulletin gives full and complete details—send for it.

See your jobber.



"Messenger Hanger" for Conduit and Cable

Strong, made of Cadmium Plated Steel or Everdur. Top loop of hanger grips messenger cable to permit conduit to be put in place without falling off.



"Messenger Strap" for Outlet Boxes

Of Cadmium Plated Steel or Everdur. For messenger cable installation to be used with Mineralac "Messenger Hanger." Fits all standard outlet boxes and ⅜" messenger cable.

MINERALLAC ELECTRIC COMPANY

New York City Office 50 CHURCH ST.
THEODORE B. DALLY
25 N. Peoria St. Chicago

Safe-T-Glow

HIGH TENSION DETECTOR

Cut-Out Shows Inside View

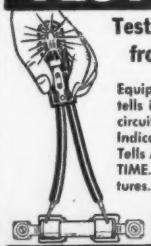
Model A 3-ft. handle

Model B 6-ft. added extension

SAFETY RULES call for that EXTRA precaution and additional RE-CHECK which SAFE-T-GLOW provides. Detects accidental tie-ins, crossovers, leakages and induced voltages . . . prevents serious injury and loss of life. SAFE-T-GLOW consists of a sensitive Neon tube, amplified by mirror reflector.

Model A for circuits 2,000 to 35,000 volts.
Model B for circuits from 35,000 to 220,000 volts.

TEST-O-LITE



Tests Everything Electrical from 100 to 550 Volts

Equipped with Neon light which tells instantly where trouble lies in circuits, fuses, cut-outs, motors, etc. Indicates hot or grounded wires. Tells AC from DC. SAVES PRECIOUS TIME. Has PATENTED safety features. Vest pocket size with clip. Lifetime guarantee. List Price $1.50 at leading jobbers.

L. S. BRACH Mfg. Corp.
55-63 Dickerson St. Newark, N. J.

The Stone You Can Bend and Twist

DRESSES AND CLEANS ALL ELECTRICAL PARTS AND CONTACTS

Flex-Stone

What a job FLEXSTONE does! Cuts like an abrasive stone—but you can bend, twist it. *Won't break!* Thin, non-brittle. Sharpest abrasives are pressed into flexible core. Easily fits tight places. Smooths hardest contact points in relays, cutouts — cleans small commutators, switches, etc. Non-conductor — no short circuit. Rimac FLEXSTONE speeds electrical service. Send for *free sample!*

RINCK-McILWAINE, Inc., 16 Hudson St., New York, N. Y.

CHANGE OF ADDRESS

McGRAW-HILL PUBLISHING COMPANY
330 West 42nd Street, New York, N. Y.

Director of Circulation:
Please change my address on Electrical Contracting

From.....

.....

To.....

.....

Signed.....

In the News

[FROM PAGE 129]

is a copy of the builder's PD-200-c showing the materials which have been approved.

In the case of non-war housing costing less than $10,000, the applicant must file PD-105 and PD-105A forms with the nearest Federal Housing Administration field office. These forms then come to WPB Regional Offices with the recommendation of FHA officials. The WPB Regional Director assigns an allotment number and a preference rating on Form CMP-L-127. Non-war housing includes the so-called "hardship" cases, which arise as a result of homes being destroyed by fire, or where new homes are made necessary because of reasons of health or safety.

In delegating to Regional Offices the power to authorize the beginning of certain types of construction costing less than $10,000, the War Production Board did not ease, in any respect, the restrictions which had existed previously in regard to construction of this kind. The new order was strictly one of decentralization and in no way implied any relaxation of wartime construction restrictions. This was emphasized today by WPB officials because the decentralization order has been widely misinterpreted.

The decentralization brought about by the order should result in considerable time-saving in the granting of preference ratings, since in the past, applications to begin construction of this kind came to WPB national headquarters. In delegating this authority to the field, WPB acted only to simplify construction procedures and to speed the processing of construction applications.

Restrictions which have covered all construction will continue in force.

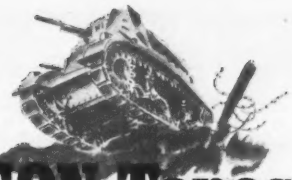
MRO SUPPLIES RE-DEFINED

Amendments to Priorities Regulations Nos. 3 and 11 have been made to revise the definitions of maintenance repair and operating supplies. The revisions bring all WPB definitions of these materials into conformity with those contained in CMP Regulation No. 5. PR No. 3 provides a uniform method of application and extension of preference rating, while PR No. 11 governs all operations of PRP units.

Specifically excluded from the definition of MRO supplies are:

1. Fabricated containers required for packaging products to be shipped or delivered.
2. Printed matter, stationery and office supplies.
3. Paper, paperboard and products manufactured therefrom; molded pulp products.
4. Fuel or electric power.
5. Office machinery or office equipment (purchased or leased).

Here's what you get Today in PANTHER and DRAGON Tapes!



FRICTION TAPE

1. Guaranteed Footage
2. Substantial Fabric
3. High Tensile Strength
4. High Dielectric Strength
5. High Adhesive Strength
6. Uniform Thickness
7. Uniform Width
8. Excellent Tackiness
9. Strong, Durable Core
10. Colorful, Attractive Boxes

RUBBER TAPE

1. Guaranteed Footage
2. High Grade Compound
3. High Tensile Strength
4. High Elongation
5. High Dielectric Strength
6. Uniformity of Thickness and Width
7. Excellent Fusion
8. High Insulation Resistance
9. Excellent Tackiness
10. Colorful, Attractive Boxes

PANTHER and DRAGON Friction and Rubber Tapes comply liberally with all the requirements of Federal Emergency Specifications as well as those of A.S.T.M.

Sixty-five years of manufacturing wire and cable insulation as well as tapes has taught us how to make long-lived tapes that will provide firmly adhering, weather-resisting mechanical splices for insulated wires and cables.

You make no mistake when you specify and use PANTHER and DRAGON Tapes as so many electrical contractors throughout the country are doing.

Rubber tapes are available in both PANTHER and DRAGON Brands.

3291

Sold Through Recognized Independent Wholesalers. • • • •

PANTHER & DRAGON
FRICTION AND RUBBER TAPES

HAZARD INSULATED WIRE WORKS — DIVISION OF THE OKONITE CO.

WILKES-BARRE, PENNSYLVANIA • OFFICES IN PRINCIPAL CITIES

LOW-COST LIGHTING OF MACHINE TOOLS

In the lighting of machine tools, installation costs can be greatly reduced by running a branch lighting circuit off the power line, using a Dongan Transformer to step down the voltage. Thousands of Dongan Transformers are performing this vital function in war industries throughout the nation. Circuit breakers optional.

WRITE
for booklet on Power Transformer Construction and Connections

DONGAN
ELECTRIC MFG. COMPANY
2985 Franklin Detroit, Mich.
"The Dongan Line Since 1909"

DONGAN TRANSFORMERS

K&H Solderless Terminal LUGS — A SIZE and TYPE for every need! — K&H Solderless CONNECTORS

TAP OR TERMINAL CONNECTORS

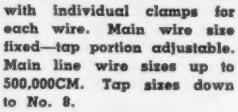
Cat. Nos. 406T-408T—Offer convenient form of connecting varying size terminals or two wires same size, with same contact applying to both. Clamping screw withdraws to create space to insert terminals. Equal force on each wire. Wire sizes 4 to 2/0.

SINGLE BRANCH TAP CONNECTORS

Cat. Nos. 1212-1228. Base common to two-wire sockets with individual clamps for each wire. Main wire size fixed—tap portion adjustable. Main line wire sizes up to 500,000CM. Tap sizes down to No. 8.

UNIVERSAL T CONNECTORS

Cat. Nos. T4-T201—Some numbers have both ends alike—adjustable over a moderate range; some have reducer end, also adjustable.



Write for BULLETIN 15-B *and* 16-A

KRUEGER & HUDEPOHL
223-8 VINE ST. · · · · CINCINNATI, OHIO

In the News

[FROM PAGE 130]

6. Clothing, shoes, or other wearing apparel (with exceptions) if made of leather or textiles.

7. Materials for plant expansion or plant construction.

The above exclusions are common to both regulations. In addition, materials for maintenance or repair of buildings have been eliminated from PR 3 and production material has been eliminated from PR 11.

The amendment however, does not prevent acceptance, during the second quarter of this year by a PRP unit, of supplies as previously defined, following proper application of preference ratings to purchase orders placed before February 23, 1943.

PD-1A DOES NOT GO TO WASHINGTON

PD-1A applications must be filed with the field office nearest the person seeking priority assistance. To send them directly to Washington entails delay in final action.

Business firms and individuals who normally apply for priority assistance on Form PD-1A are warned by War Production Board officials that only applications made on the revised version of that form issued January 16, 1943, will be considered.

The new form is printed in two colors, yellow to be used in applying for preference ratings for items to be exported without further processing in the United field offices.

WPB ACTIVITY DECENTRALIZED

Another long step in the decentralization of War Production Board activities was made, when Chairman Donald M. Nelson issued the new WPB administrative order which directs applications for priority assistance on Form PD-1A be filed with the nearest of the 131 WPB district offices, and authorizes the 12 Regional Offices to assign preference ratings on PD-1A certificates to deliveries of materials States, and white for all others. Ample supplies of each are now available in WPB valued at $100 or less.

Mr. Nelson said that the preliminary value limitation of $100 would be progressively stepped up as the field offices assume greater responsibilities and he expected that within six weeks, more than eighty per cent of all PD-1A applications would be handled entirely by the Regional Offices.

Under the new procedure, which will simplify greatly the problems of businessmen and others needing occasional priority assistance, WPB's field offices will be responsible for seeing that all PD-1A applications are properly filled out and will forward them to Washington, or to

SEARCHLIGHT SECTION
(Classified Advertising)
Employment Business Equipment
(Used or Resale)
"OPPORTUNITIES"

UNDISPLAYED RATE
15 Cents a Word, Minimum Charge $3.00. POSITIONS WANTED (full or part time salaried emlovment only), ½ the above rates payable in advance.
BOX NUMBERS—Care of publication New York, Chicago or San Francisco offices count as 10 words. DISCOUNT OF 10% if full payment is made in advance for 4 consecutive insertions.

DISPLAYED RATE
INDIVIDUAL SPACES with border rules for prominent display of advertisements.
The advertising rate is $7.50 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request. AN ADVERTISING INCH is measured ⅞" vertically on one column. 3 columns—30 inches—to a page.
NEW ADVERTISEMENTS received by May 21st will appear in the June issue, subject to limitations of space available.

READY TO SHIP
REBUILT ELEC. EQUIP.
AC-DC Motors, 1 to 1500 HP
M. G. Sets—Rotary Converters
Transformers
Engine Generator Sets
Pumps—Air Compressors
Switchboards—Meters—Switches
Send for Catalog
DUQUESNE ELECTRIC & MFG. CO.
Pittsburgh, Pa.

340 K W
DIESEL ELECTRIC UNITS
Complete with all meters and switchboard to be sold as one unit. 3 Wire 120-208 Volts 60 cycle.
For details write J.R.F.
Room 1701, 505—5th Avenue New York

CLOSEOUT
800 New Black & Decker 1/20—1/25 H.P. Fan Duty Motors.
FACTORY PACKED
H. U. MANN
540 Lake Shore Dr. CHICAGO

the Regional Offices if they fall within the value limitations set by the order.

Another administrative order has been issued which empowers Regional Offices to authorize construction under Conservation Order L-41, and to assign preference ratings to deliveries of necessary scarce materials to building operations costing less than $10,000, except industrial and certain other listed types of construction. Applications for authority to begin construction under this procedure are also to be filed with the nearest WPB district office.

In the early days of the priorities system, Form PD-1, later supplanted by PD-1A, was the principal instrument in the assignment of preference ratings to orders for scarce materials. Later, the Production Requirements Plan, now being superseded by the Controlled Materials Plan, provided the means for distribution of the great bulk of material required for military and essential civilian production, and receipt of the PD-1A forms has dropped from a one-time peak of more than 60,000 a week to only a little more than one-half of that number at the present time. The fact that CMP provides central control over the distribution of scarce materials to claimant agencies, makes it possible to decentralize handling of PD-1A's.

Ratings assigned on PD-1A certificates are known as "single-shotters," since the priority assistance they provide is applicable only to the particular delivery for which help is requested. They do not establish the continuing assistance provided by PRP and CMP, and by orders in the "P" series covering specified industries.

WITH THE Manufacturers

G.E. Appointments

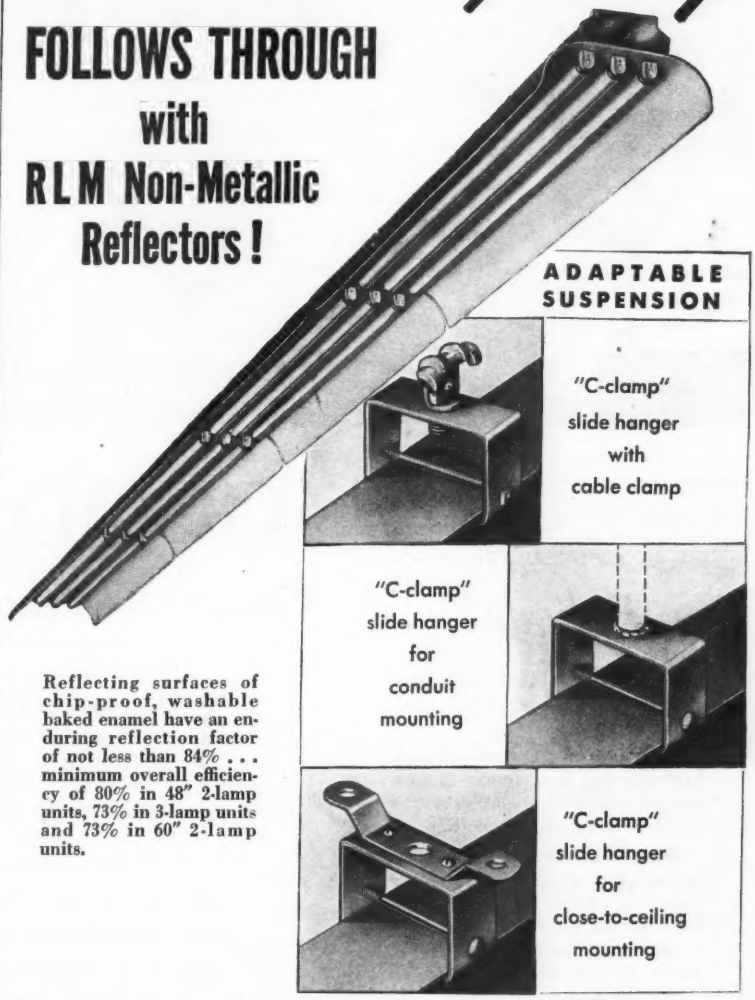
M. I. Alimansky has been appointed engineer in charge of the capacitor section at General Electric's Pittsfield Works; Charles F. Miller as manager of capacitor sales; and Fred G. Stebbins as assistant manager of sales of the distribution transformer and feeder regulator section.

The appointment of several G.E. wiring material field representatives to replace men joining the armed forces is announced. In field district No. 4, with headquarters at Cleveland, Ohio, there are two changes. S. D. Hopper is promoted from field representative to acting manager of the district office, replacing O. W. Cerny. E. O. Callander, who had been with General Electric Supply Corporation in Toledo, Ohio, becomes field representative in district No. 4.

H. O. Dodson is the new field representative in district No. 5, with headquarters at Indianapolis, Ind., succeeding H. J. Kowal. Mr. Dodson was formerly with G.E. Supply Corp. in Chicago and Indianapolis.

K. K. Crook is assigned to the Wisconsin territory in district No. 5 with headquarters in the Chicago district office. He

"Skilled" Lighting FOLLOWS THROUGH with RLM Non-Metallic Reflectors!


ADAPTABLE SUSPENSION
"C-clamp" slide hanger with cable clamp
"C-clamp" slide hanger for conduit mounting
"C-clamp" slide hanger for close-to-ceiling mounting

Reflecting surfaces of chip-proof, washable baked enamel have an enduring reflection factor of not less than 84% . . . minimum overall efficiency of 80% in 48" 2-lamp units, 73% in 3-lamp units and 73% in 60" 2-lamp units.

With metal at a premium . . . you can still have the advantages of "Skilled Lighting"! Wheeler engineers . . . lighting specialists with over 61 years' experience . . . have developed fixtures with non-metallic reflectors that meet all requirements of wartime industry for efficient fluorescent lighting.

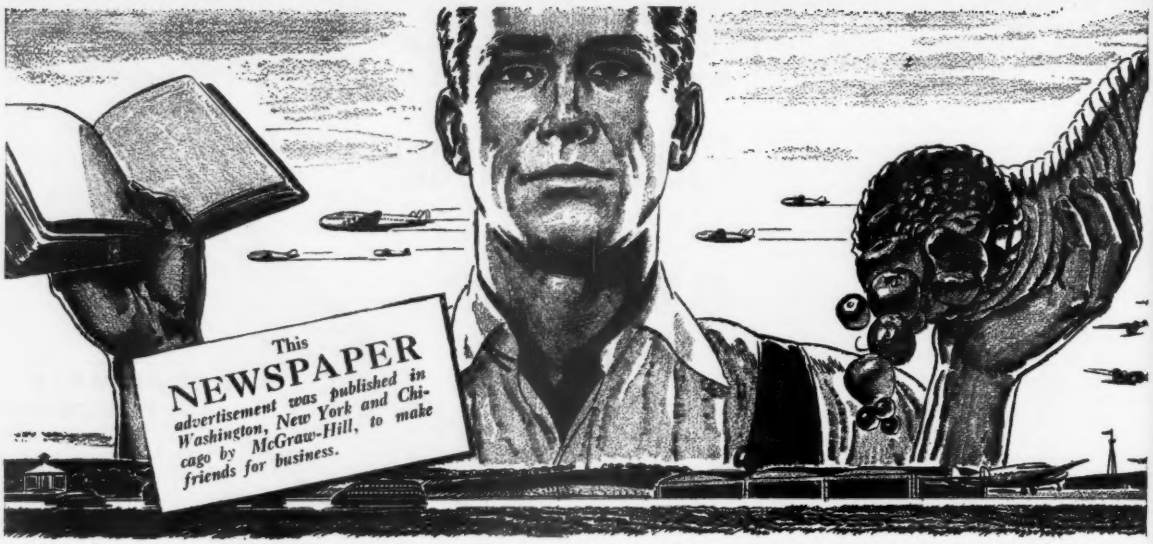
Wheeler "War-Aid" Reflectors fulfill high standards of construction as well as illumination. Non-flammable, moisture-resistant, rugged . . . equipped with special features that simplify installation and maintenance. In every way now practical, they're typical Wheeler "Skilled Lighting!"

Write for new bulletin No. 71 on Wheeler "War-Aid" Fixtures and catalog of Wheeler Incandescent Fixtures. Wheeler Reflector Company, 275 Congress St., Boston, Massachusetts . . . New York . . . Cleveland. Representatives in principal cities.

Distributed Exclusively Through Electrical Wholesalers

Wheeler REFLECTOR COMPANY

Lighting Equipment Specialists Since 1881


This
NEWSPAPER
advertisement was published in Washington, New York and Chicago by McGraw-Hill, to make friends for business.

Do You Believe?

Do you believe that Industrial Progress is the basis of all good living?

That Industry is the source of better living is so clear to you and me that it would seem everybody would understand it.

But when we try it on your friends and neighbors! Or, review the course of history! Or look among our laws to see how many were designed to encourage industrial growth!

You'll find that few people know where good living comes from.

We are trying to explain the source of good living in McGraw-Hill magazines, and in newspapers. A current advertisement is shown here.

We ask other companies, all over the nation, to join us in running the "Seed Money" message. We supply free mats (1,470 line size, for newspaper use) with space for name of local sponsor.

James H. McGraw, Jr.

President

McGraw-Hill Publishing Company, Inc.

GOOD LIVING

Comes *Only* from Industrial Progress

THE more we believe in the Four Freedoms, the greater our obligation to understand them, and to know exactly what we have to do to enjoy *all* of the advantages they imply.

Take Freedom from Want, for instance. Where will it come from? Will it be the gift of a government department? Can it be created by issuing orders and directives?

► Of course not. Executives and government departments get their powers as well as their money from Congress. Can Congress create Freedom from Want by law?

Not in the final analysis. Congress can only allocate the total energies of our nation by law. It can take all the good living there is and divide it up differently.

So, if you happen to live poorly and want to live better, it's to your interest to see that Congress does a very wise job when the time to divvy up arrives.

Reprints of this advertisement are available in booklet form. (Less than 100 copies free. Larger quantities, $1.50 per 100; $10.00 per 1000.)

UMI

Good Living Comes Only from Industrial Progress (cont'd)

Congress can assume either that industry can't grow any more and try to solve the problem by dividing up existing jobs, or it can stimulate *more* good living, through wise laws that encourage Industrial progress and make more jobs.

► Multiplication will work a lot better than division, in this case.

If Congress will hold on to the fact that art, science, political experiments, luxuries AND necessities *all* must have their foundations in healthy industry, it will be more likely to pass only those laws which encourage industrial growth.

"Seed Money" an Example

When Congress, and the people, realize that business progress is the foundation of all improvement, our tax laws will stop confusing personal profit (salaries and dividends) with reinvested profit.

Profit held for reinvestment is the SEED MONEY of business. It is the money a business saves from current operations to insure future growth.

► Business will need billions of "Seed Money" dollars when the war is over. But, under the present tax law, industry cannot save as it should for that rainy day.

You hear lots of talk about the jobs that will result from the transparent automobiles and the sky-sedans that industry will build after the war, but not enough talk about the need for SEED MONEY to turn those hopes into realities.

The practical fact is that business cannot adjust itself to postwar production without "Seed Money."

► "Seed Money" will pay for the research that must come before new and better postwar products can be built. It will pay for re-tooling when new models are produced. It will pay for the study of methods to get the lower costs that will make it possible for more people to buy. It will pay for setting up new distributors and dealers, and for hundreds of other activities that are involved in the growth of business.

The tax law should be adjusted to allow business to accumulate funds for these necessary tasks of postwar development.

Ask your Congressman to see that American business is given a chance to create jobs after the war, by revising the excess profits tax so as to leave the "Seed Money" and by reviewing all laws with this principle in mind:

"Industrial Progress
is the Source of all Good Living."

THE McGRAW-HILL NETWORK OF INDUSTRIAL COMMUNICATION

22 publications, which gather "war-news" from the "war-production-front" through a staff of 153 editors and 725 engineer-correspondents . . . More than 1,500,000 executives, designers, production men and distributors use the editorial and advertising pages of these magazines to exchange ideas on war-production problems.

McGRAW-HILL BOOKS

Publishers of technical, engineering and business books for colleges, schools, and for business and industrial use.

McGRAW-HILL

PUBLISHING COMPANY, INC. . . . BOOK COMPANY, INC.

330 WEST 42ND STREET, NEW YORK

THE McGRAW-HILL NETWORK OF INDUSTRIAL COMMUNICATION:

American Machinist • Aviation • Bus Transportation • Business Week • Coal Age • Chemical & Metallurgical Engineering • Construction Methods • Electrical Contracting • Electrical Merchandising • Electrical West • Electrical World • Electronics • Engineering & Mining Journal • E. & M. J. Metal and Mineral Markets Engineering News-Record • Factory Management & Maintenance • Food Industries • Mill Supplies • Power • Product Engineering • Textile World • Wholesaler's Salesman • Business Publishers International Corporation, an affiliate, publishers of Business and Technical Magazines for Latin America, and Overseas Circulation.

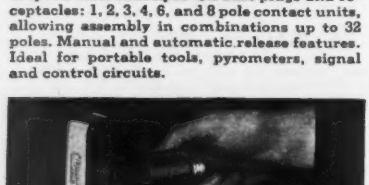
PLUGS and RECEPTACLES You need—

The plugs and receptacles you need are easy to find in the complete Pyle-National line, which includes types, sizes, and ratings for all kinds of portable equipment, signal and control circuits, pyrometers, extension lights, portable tools, welders, battery chargers, and similar equipment. Write for general catalog 1100.

General Purpose plugs and receptacles: 1, 2, 3, 4, 5 poles; ratings 30, 60, 100, 200 amperes. Round prong contacts, rugged cast metal housings to withstand severe service.

QuelArc circuit breaking types: 2, 3, 4 wire types, ratings up to 200 amperes. Exceptional protection to contacts, for safe use as current rupturing devices.

Triploc and Multiple Circuit plugs and receptacles: 1, 2, 3, 4, 6, and 8 pole contact units, allowing assembly in combinations up to 32 poles. Manual and automatic release features. Ideal for portable tools, pyrometers, signal and control circuits.



Midget Triploc, compact, but with many exclusive heavy duty features for dependable service under severe conditions: 2, 3, 4 pole types.

Write for your copy of Pylet Catalog 1100 with complete listings of all types.

The Pyle-National Company
1344 N. Kostner Ave. • Chicago, Ill.

In the News

[FROM PAGE 133]

has been water heater and range representative in the Chicago district.

H. C. Maccubbin replaces Arnold Jensen as representative in district No. 2 with headquarters in Philadelphia. He had been with the G.E. Home Bureau.

R. O. Snyder becomes field representative in district No. 5. From headquarters in St. Louis, Mo., he will cover the territory in Illinois, Missouri and Arkansas formerly assigned to W. W. Bryan. Mr. Snyder had been with G.E. wiring materials headquarters offices in Bridgeport.

To help industry with electronic application problems, 18 G.E. industrial electronic specialists have been appointed. These specialists will be responsible for all industrial electronic applications in their territories.

The new specialists include: I. C. Diefenderfer and D. C. Hierath, New York City; J. F. Getz, Philadelphia; A. J. Moore, Boston; W. B. Frackelton, Chicago; L. E. Donahue, Los Angeles; J. A. Setter, Denver; I. F. Conrad, St. Louis; A. D. Boardman, San Francisco; L. B. Parsell, Detroit; L. R. Elder, Portland, Ore.; Frank C. Neal, Jr., Dallas; R. H. Jackson, Atlanta; K. H. Keller, Cleveland; R. C. Norris, Cincinnati; A. M. Dawson, Pittsburgh; B. Cogswell, Buffalo and L. F. Stone, Newark.

•

Trumbull Changes

The Trumbull Electric Mfg. Co. announces the appointment of L. C. Watson as New England district manager with headquarters at the Plainville factory.

R. M. Booth, has been assigned to the New England territory with headquarters in Boston. He takes the place of Bill Edwards, recently transferred to Kansas City as district manager.

•

Triangle Changes

The Triangle Conduit & Cable Co., Inc. of New Brunswick, N. J. have made the following changes in their sales organization:

John Cushman, 340 Royal Palm Way, Palm Beach, Fla., district representative for the state of Florida, east of Pensacola.

John Naylor, 621 Julia St., New Orleans, La., is district representative for the states of Louisiana, Mississippi and the cities of Mobile, Ala. and Pensacola, Fla.

C. H. Kaufman, Triangle Pacific Company, 340 Azusa St., Los Angeles, Calif., will cover the states of California, south of but not including Bakersfield, Arizona, and Las Vegas, Nev.

Rex Larsen, district manager, Triangle Pacific Company, 1045 Bryant St., San Francisco, will cover the states of California, north of and including Bakersfield, Nevada except Las Vegas and Utah.

Robert Sloane, district manager, Triangle Pacific Company, 95 Connecticut St., Seattle, Wash., will take care of the states of Oregon, Washington and Montana, west of Billings and Idaho.

•

Westinghouse Appointments

Thomas C. Finnell has been appointed manager of the Industrial Department in the Eastern district of the Westinghouse Electric and Manufacturing Co. Mr. Finnell succeeds C. W. Miller, who was named manager of the Application Department of the Westinghouse Radio Division at Baltimore.

J. R. Sargent has been appointed acting manager of the Market Development Department. He succeeds Donald C. Hooper, who has accepted a commission for active service in the U. S. Navy.

Thomas T. Bakke, formerly with the Westinghouse Engineering and Service Department in Milwaukee, has been appointed manager of the Milwaukee branch.

•

Copperweld Appointments

Copperweld Steel Company of Glassport, Pa., announces the appointment of William J. McIlvane as vice-president in charge of sales and assistant to the president. Mr. McIlvane was formerly general manager of sales.

McILVANE

Harry J. Billica has joined the Copperweld sales organization. He was formerly senior industrial specialist in WPB's office of War Utilities at Washington.

•

Westinghouse Supply Elects

George E. Carpenter was elected treasurer and assistant secretary of the Westinghouse Electric Supply Company. He succeeds W. M. Dick, who resigned after 40 years of service.

John J. Kaske has been appointed assistant chief stores manager. He was formerly district stores manager in St. Louis.

•

Arrow-Hart and Hegeman Electric Company, Hartford, Conn. announces the election of Haynes L. Everest as vice-president. Mr. Everest has been with the company continuously for 36 years.

•

Sylvania Company Elections

Walter E. Poor, executive vice-president, has been elected president of Sylvania Electric Products, Inc., succeeding B. G. Erskine, now chairman of the board. Noel E. Keeler, controller, and assistant treasurer, has been made treasurer, and Philip P. Borden has been named assistant treasurer. New directors elected are W. J. Wardall, C. F. Hockley, D. G. Mitchell, N. E. Keeler, R. M. Wise and E. F. Carter.

UMI

Littelfuse Promotions

At its last meeting the Board of Directors of Littelfuse Incorporated elected as vice-presidents Ash Wood, sales manager at the El Monte, California plant and Gerald E. Spates, general manager of the Chicago plant.

Miss Irene Mueller, secretary to E. V. Sundt, president, was elected assistant secretary of the company.

•

Federal Electric Products Company of Newark, N. J., announces the appointment of Daniel F. Barnard as sales manager. Mr. Barnard was formerly with the Champion Lamp Works of Lynn, Mass.

•

Allis-Chalmers Mfg. Co., has named Robert C. Allen as manager of the steam turbine department, succeeding the late Arthur C. Flory. He was formerly assistant manager.

•

Fairbanks, Morse & Co., announces the appointment of Robert H. Morse, Jr. as general sales manager.

Estimating Special Boxes And Troughs

[FROM PAGE 42]

ation is installed to facilitate cable installation, the most difficult portion of the cable "pull" is at the pull box or trough, where the cable must be formed and refed. It is entirely appreciable that, to prevent excessive elbows, and field bends, etc., it may be necessary to install several pull boxes in a relatively short run of conduit. This is going to throw labor units for that portion of the cable pull out of proportion.

The formula has no labor included for conduit terminals, which can be considered under "conduit installation." No other labor is figured for the pulling of cables, splicing, lugging, etc., beyond the consideration for refeeding which is reflected in the multiplier. The formula is without consideration for sizes of conduits or cables entering the pull box. The size of the pull box will be determined by the sizes and quantities of cables etc., entering the box, and the additional man hours will be reflected by the multiplier applying to a larger dimension on the larger boxes, as compared to the smaller boxes which would have smaller conduits entering and leaving the enclosure.

No labor is included for abnormal conditions involving difficulty in receiving, transporting within the building, unusual mounting heights, and scaffolding.

Emergency Wires

[FROM PAGE 38]

cally approved for the condition, may be used as the grounded conductor in any of the wiring methods of Article 320 to 364 incl. of this chapter."

Type EG is Underwriters' Laboratories' designation for the wire of a "type specifically approved for the conditions." It may be used in non-metallic sheathed cable, armored cable, and lead sheathed cable. The wire is recognized in sizes No. 14 AWG and larger. The No. 8 AWG or smaller may be either solid or stranded, and No. 6 or larger shall be stranded. There shall be an inner covering and an outer covering.

The covering shall be circular in cross-section and applied concentrically about the conductor. The thickness of the coverings for No. 14 to 8 AWG shall not be less than $\frac{3}{64}$ inch. For the larger sizes the covering is proportionally thicker. The outer covering shall be a saturated fibrous material applied directly to the inner covering. This covering shall comply with the usual requirements for fibrous coverings for single-conductor Type R rubber covered wire.

As usual, the finished wire shall have a distinctive marking throughout its entire length by which it may be identified readily as the product of a particular factory. The coil or reel of wire or cable shall be tagged to indicate plainly the manufacturer's name and, if desired, the trade name of the wire, the proper type letter, such as "EG", the AWG or circular-mil size of the wire, the words "National Electrical Code Emergency Standard," the words "Identified Grounded Wire," and the manufacturer's identifying marker.

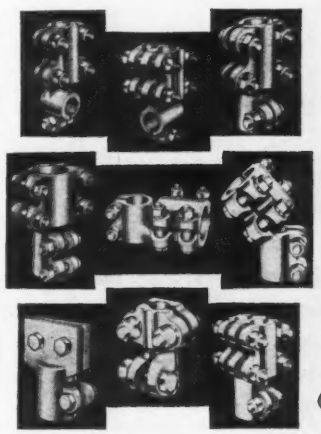
Under the same Interim Amendment, No. 44, Type WP weatherproof conductors finished to show a white or natural gray color are acceptable for use as identified grounded conductors in interior wiring. This wire shall be plainly tagged: "Identified grounded conductor."

Slow-burning, weatherproof wire, Type SBW, may be used as the identified, grounded conductor in non-metallic sheathed cable.

Type SN wire is recognized by Interim Amendment No. 46 and may be used wherever Types R, RP and RH rubber-insulated conductors are acceptable. Of all the types of wire discussed, Types WP, SBW, SN, EI or EG may be used as the identified grounded conductors, and Types SN and EI may be used for any insulated conductor in non-metallic sheathed cable.

— from the COMPLETE line"

Stud Connectors and Solderless Terminal Adapters for distribution and power transformers . . . for connecting to cable, pipe or bus bar . . . in line or at any angle. Connectors with reversible clamping caps take two different ranges of cable sizes. Furnished for any number of conductors. A few of Penn-Union's many types:



Also . . . the most complete line of Service Connectors, Cable Taps, Tees . . . Straight and Parallel Connectors . . . Bus Supports, Spacers . . . Grounding Clamps, Terminal Lugs, etc. etc.

Penn-Union conductor fittings are the first choice of leading utilities, industrials, electrical manufacturers and contractors—because they have found that *"Penn-Union" on a fitting is their best guarantee of Dependability.* Write for Catalog.

PENN-UNION ELECTRIC CORPORATION
ERIE, PA. *Sold by Leading Jobbers*

PENN-UNION
Conductor Fittings

—KONDU has it!"

You get *exactly* what you need, when you use Kondu. The wide variety makes it easy to select the fitting that's *just right* for your job.

And with any Kondu fitting, you can—

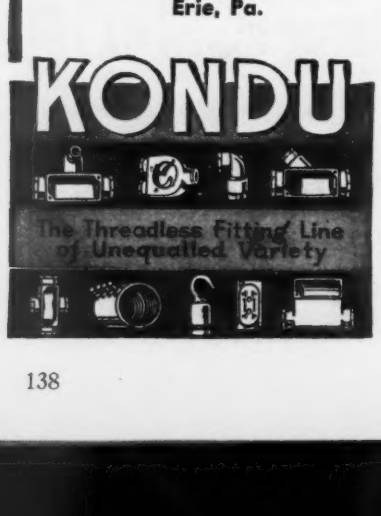
Use Thin-Wall or Thick-Wall conduit, at any outlet, making either a Threadless or Threaded connection.

Change Boxes any time, without disturbing conduit — because every Kondu box is a union. (Or you can install a conduit line before you get the fittings).

100% re-usable . . . Kondu fittings are practically unbreakable. Self-aligning, they are quickest to install . . . and hold permanently tight; vibration-proof.

Write for the Kondu Catalog

KONDU CORPORATION
Erie, Pa.



Non-Critical Supports

[FROM PAGE 37]

sections on the ground, completely wired and then hoisted them up and clamped the units into the yokes on the cross arm supports. After all trades were finished in that area, men would go back, straighten out the units, tighten the bracket bolts and align the rows. All assembly work was done on the ground. One man was kept busy mounting fixture brackets to the cross arm supports and drilling them for mounting bolts. A second crew was busy wiring, assembling and lamping the 66-ft. section; a third hoisting and clamping the units into place and making the necessary connections to the feeders and sub-feeders in the trusses.

Emergency lighting in the assembly building is of the incandescent type providing an intensity of $\frac{1}{10}$-watt per square foot. A total of sixteen $7\frac{1}{2}$ kva. air cooled transformers, fed by a separate primary circuit, energize this system. These transformers, each with an eight circuit lighting panel, are located at various mezzanine substations. Although normally fed from the utility lines, this emergency circuit which also feeds certain essential equipment, can, in the event of a sustained interruption, be transferred through an automatic switch to a 500 kva. turbo-generator in the boiler room. Once on the emergency generator, the system must be manually restored to the utility lines to prevent paralleling the generator with the utility service.

Protective Lighting

A total of 500 kw. of protective floodlighting is distributed in banks of two or three 1500-watt units at strategic points along the exterior of the building. Here again, considerable copper was saved by using a primary distribution system to each bank of units where a 3 kva. or 5 kva. transformer was installed. Heavier secondary circuits were thus confined to the short distances from the transformers to the lighting units.

Overhead series circuits were employed on 110 kw. of parking lot and protective fence lighting. The protective lighting is controlled by an astronomical time switch which takes into consideration the different rising and setting time of the sun throughout the seasons and prevents the lights from being turned on or off too early or too late.

In terms of critical materials saved, what was the outcome of all this careful design and choice of equipment? A comparison with a comparable conventional conduit job gave the following estimate:

Switchgear—By designing the system so that 50,000 instead of 150,000 KVA. interrupting capacity equipment could be used, the *saving in steel ran approximately 25 percent; copper, 50 percent.*

Distribution System—By employing open wiring and high tension distribution, wood substations and structures and taking advantage of the increased carrying capacity of conductors in free air, *about 250 tons of steel were saved and copper economy ran about 60 percent.* And the use of varnished cambric and other insulation on heavy feeders saved considerable rubber.

Lighting Fixtures—The substitution of non-metallic reflectors on the fluorescent units *saved about 180 tons of steel.* The use of one ballast to operate four fluorescent lamps *reduced electrical losses by approximately 46 percent; saved 47 percent in copper, and 50 percent in aluminum.*

Some may look upon this design as a reversion to wiring methods of some 40 years ago, what with open wiring, wood structures and the like. But when you balance this with the economy of critical materials, it is justified.

More Gossip

Maryland NECA Officers Elected

The annual meeting of the Electrical Contractors Association of Maryland, Inc., elected the following officers: Charles H. Stark, Stark Electric Co., president; Arthur S. Raffel, Charles Electric Co., vice president; Edward K. Henry, Francis C. Dorsey Appliance Corp., secretary-treasurer. Members named to the Executive Committee for 1943 were J. Roland Stolzenbach, V. M. Miller, John M. Heath, Frank M. Meredith and Arthur S. Raffel.

Contractor Quiz on N. E. Code

A recent meeting of the Electrical Contractors' Division of the Cincinnati Electric Association was conducted in a novel manner when those present were given a "General Achievement Test" on the National Electrical Code. Arthur L. Racke and Paul W. Schath brought copies of the questions back from the recent convention of the Kentucky Chapter, I.A.E.I. A prize offered to the member answering the greatest number of the 43 questions correctly was carried off by George Carr. Not a bad idea to check up on ourselves occasionally to see how much of the Code we have forgotten.

Steel As Substitute A.C. Conductors

[FROM PAGE 45]

degree C. rise steel bus directly to a switch lug since enough heat would transfer to raise the switch above 30 degrees C. rise. This objection could be overcome by installing a short overrated copper section between the steel bus and switch. Brazed or soldered joints between steel and copper are desirable to prevent copper oxidation at higher temperatures.

Application

Although the use of steel as a conductor is primarily considered in terms of high voltage lines with comparatively low currents and where voltage drop is not too serious, it has possibilities in the low voltage field.

With the pinch on copper becoming more serious, steel conductors might well be considered in such low voltage applications as primary and secondary bus work on transformer mats, short main feeder runs into buildings and short distribution feeders where the current requirements are moderate. Resetting voltage regulators or transformer taps might help in this application.

Voltage drop, which is exceptionally high in steel conductors, is a factor very definitely limiting this substitute on low voltage, high current circuits. Prime consideration should be given to this when designing a system using steel conductors. However, like copper and other conductors, steel can be paralleled to increase the capacity of the circuits. One interesting example of this was an installation in the mid-west. Two 3½-in. slotted water pipes paralleled per leg were used to carry 700 amperes at 440 volts, 3-phase, to a bank of resistance type welders balanced on the three phases. It should be remembered that capacities shown for the various steel sections are set on a continuous service basis. If service is intermittent, such as a welder, much higher capacities can be used.

Steel conductors have been used on high tension work. They may not be the complete answer to low voltage problems. But, when used intelligently, they can provide an out for certain plant electrical work that would otherwise have been delayed or held in complete abeyance because of the critical materials situation. The system merits careful consideration.

WHERE TO BUY

Equipment, Materials and Supplies for Electrical Construction — Maintenance — Repairs

TORK

TURN ANYTHING ELECTRICAL ON & OFF REGULARLY

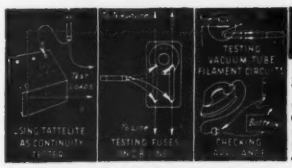
The TORK CLOCK CO., Inc
MOUNT VERNON, NEW YORK

DRILLS CONCRETE—METAL—WOOD

WODACK "DO-ALL" ELECTRIC HAMMER AND DRILL

Saves time and money installing expansion anchors. Drills concrete to 1⅜" dia.; metal to ⅜". Two tools in one. Easy to maintain. Universal motor. Star drills in 17 diameters. Also chisels, bull points, etc. Write for bulletin.

Wodack Electric Tool Corporation
4628 W. Huron St. Chicago, Ill.
Telephone AUstin 9866



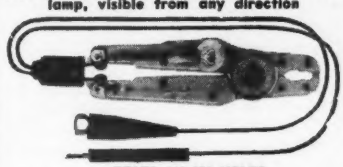
3 LITTELFUSE *Pocket* TATTELITES

3-20 V., and 6-50 V. $1.75 ea. 60-500 V., $1.00

Check instruments, radio, communications, airplanes, etc., for open circuits and scores of troubles. *"Tattelite tells the tale".*

LITTELFUSE INC., 4789 Ravenswood Ave., Chicago, Ill.

NEW DESIGN
Strong, transparent, plastic carbon test lamp, visible from any direction



TESTS 110-250 VOLTS

Insulated pliers for testing and pulling fuses. Folding prongs fit base plugs. Test cord attachable.
Can be obtained from G.E.—Westinghouse, or other first class jobbers

STAR TEST POCKET PLIERS
235 Canal St. New York, N. Y.

ELECTRIC MOTOR
PARTS
FOR ALL MAKES

One of the largest consolidated stocks of motor, fan and controller parts on the east coast.

Write for Catalogue

READING ELECTRIC CO.
INCORPORATED
200 William St. New York City

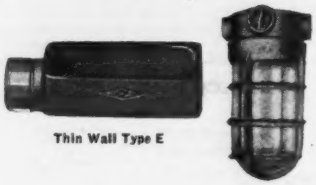
A Good Habit . . .

This Where to Buy Section supplements other advertising in this issue with these additional announcements of products and services essential to efficient and economical operation, maintenance and service. Make a habit of checking this page, each issue.

Departmental Staff, ELECTRICAL CONTRACTING

SIMPLET
CONDUIT FITTINGS

Thin Wall Type FS



Thin Wall Type E

Universal vapor tight fixture

No finer fitting made
— All Styles — All Sizes

Simplet engineers can help you with your sales problems—call on them today.

SIMPLET ELECTRIC CO.
112 Charlton St. New York City
123 N. Sangamon St. Chicago, Ill.

TEST INSULATION . . . . .
the modern, easy way with a
MODEL B-5
MEGOHMER

No more tiresome cranking of a hand-driven generator. . . . . Our new battery-vibrator type insulation testers operate at a steady test potential of

500 VOLTS DC

available at the touch of a switch, portable, entirely self-contained, direct-reading.

Write for bulletin No. 430.

HERMAN H. STICHT CO., INC.
27 PARK PLACE NEW YORK, N.Y.

Alphabetical Index to Advertisers

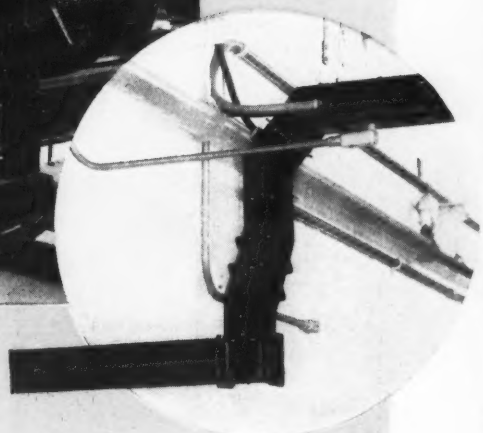
May, 1943

	Page
*Adam Electric Co., Frank	83
*Aerovox Corp.	122
*Allen-Bradley Co.	75, 76
Aluminum Co. of America	87
American Auto. Elec. Co.	20
*American Transformer Co.	113
Anaconda Wire & Cable Co.	32
*Appleton Electric Co.	2
Arrow-Hart & Hegeman Elec. Co.	28
*Artkraft Electric Co.	86
Automatic Alarms, Inc.	116
*Beaver Pipe Tools, Inc.	72
*Benjamin Elec. Mfg. Co.	62
Blackhawk Mfg. Co.	126
Brach Mfg. Corp., L. S.	130
*Briegel Method Tool Co.	71
*Bright Light Reflector Co.	96
Bryant Electric Co.	4
*Bull Dog Elec. Prod. Co.	80
Century Electric Company	61
*Champion Lamp Works	123
Chase Shawmut Co.	13
Chicago Tool & Eng Co.	71
Colt's Patent Firearms Mfg. Co.	22
Crescent Ins. Wire & Cable Co.	24
Crocker-Wheeler Elec. Mfg. Co.	57
*Curtis Lighting, Inc.	81
Cutler-Hammer, Inc.	58
*Dongan Elec. Mfg. Co.	132
Duquesne Elec. Mfg. Co.	132
*Edwards & Co.	97
Electric Equipment Co.	132
Electrical Buyers Reference	128
Electro Mfg. Co.	53, 54, 55
Emerson Elec. Mfg. Co.	16
Ethyl Corp.	14, 15
F., J. R.	132
Federal Elec. Prod. Co.	114
Fostoria Pressed Steel Co.	31
*Fullman Mfg. Co.	93
*General Electric Co. (Bridgeport) Back Cover, 98, 110	
*General Electric Co. (Nela Park)	95
*General Electric Co. (Schenectady) Inside Front Cover, 5, 8, 9, 11, 12	
Goodrich Electric Co.	104
*Graybar Electric Co.	34
*Greenlee Tool Co.	115
*Guth Co., Edw. F.	7
*Hazard Ins. Wire Works Div.	10, 131
*Ideal Commutator Dresser Co.	60
*Illinois Electric Porcelain Co.	94, 103
*Ilsco Copper Tube & Prod. Co.	124
Insto-Gas Corp.	124
*Insulation and Wires, Inc.	74, 129
*Jefferson Electric Co.	29
*Johns-Manville	121
*Johnson Bronze Co.	73
*Kato Engineering Co.	122
*Klein & Sons, Math.	119
*Knox Porcelain Corp.	103
Kondu Corp.	138
*Krueger & Hudepohl	132
*Lighting Products, Inc.	23
Littelfuse, Inc.	139
*Lloyd Products Co.	118
Mann Co., H. U.	132
*McGill Mfg. Co.	84
McGraw-Hill Book Co.	108, 112
*Metropolitan Device Corp.	1
Miller Company	92
*Minerallac Elec. Co.	130
Mitchell Mfg. Co.	127
Multi Elec. Mfg. Co.	124
National Electric Products Corp.	74
*Okonite Co.	10, 131
*Overbagh & Ayres Mfg. Co.	78
*Owens-Corning Fiberglas Corp.	105
*Paine Co., The	120
Paragon Elec. Co.	126
Pass & Seymour, Inc.	112
*Penn-Union Elec. Corp.	137
Pittsburgh Reflector Co.	88
*Porcelain Group	103
*Porcelain Products, Inc.	103
Pyle-National Co., The	136
Quadrangle Mfg. Co.	120
Reading Electric Co., Inc.	139
Republic Steel Corp.	79
*Ridge Tool Co.	67
Rinck-McIlwaine, Inc.	130
*RLM Standards, Inst. Inc.	59
Robbins & Myers, Inc.	19
Robertson Co., H. H.	109
*Rusgreen Mfg. Co.	126
*Sangamo Electric Co.	27
Searchlight Section	132
*Simplet Elec. Co.	140
Simplex Wire & Cable Co.	129
*Spero Electric Corp.	116
Square D Company...Inside Back Cover	
Startest Pocket Pliers	139
Steel & Tubes Div.	79
*Sticht Co., H. H.	140
*Superior Carbon Prod. Co., Inc.	73
Superior Instruments Co.	124
*Sylvania Electric Products, Inc.	51, 107
Tal's Prestal Bender Co.	118
Thomas & Betts	91
*Tork Clock Co.	139
Trico Fuse Mfg. Co.	74
*Trumbull Elec. Mfg. Co.	85
Union Insulating Co.	108
*United States Rubber Co.	17, 68, 69
U. S. Treasury Dept.	111
Victor Electric Prod Co.	106
Wabash Appliance Corp.	26
Wagner Elec. Corp.	6
*Ward Leonard Electric Co.	106
*Ware Brothers, Inc.	72
*Westinghouse Elec. & Mfg. Co. (East Pittsburgh)	21, 25, 117, 125
*Westinghouse Elec. Supply Co.	101
*Weston Electrical Instr. Corp.	18
*Wheeler Reflector Co.	133
Where To Buy	139
Wiremold Company	30
Wodack Electric Tool Corp.	139
Youngstown Sheet & Tube Co.	89
Zenith Electric Co.	120

★ **These companies have included Briefalogs, containing additional buying information on their products, in the 1943 edition of the Electrical Buyers' Reference.**

UMI

Flexible POWER DISTRIBUTION



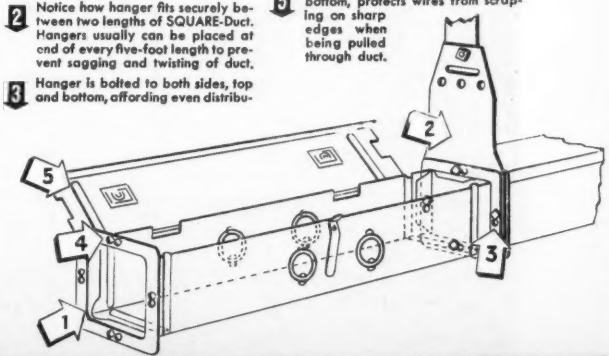
WITH SQUARE-Duct

SQUARE-Duct offers flexibility for the locating and relocating of machines which is not obtainable with solid conduit. Knockouts every three inches make it possible to connect through short runs of conduit. Since SQUARE-Duct can be installed at uniform height, it is often possible to reconnect the old conduit at another point—a valuable time and material saver.

Notice, too, in the illustration at the upper right, how a wide variety of standard elbows and fittings makes it extremely simple to run SQUARE-Duct around pipes, beams, corners, and into normally difficult locations.

The initial cost of SQUARE-Duct is practically the same as for conduit wiring. Installation cost is substantially lower. Write for Bulletin 6000 which gives complete details.

1. Drawn collar affords secure support for the duct and automatically aligns each length to prevent twisting. It also serves as a stable connection to the adjacent length equipped with a similar collar.
2. Notice how hanger fits securely between two lengths of SQUARE-Duct. Hangers usually can be placed at end of every five-foot length to prevent sagging and twisting of duct.
3. Hanger is bolted to both sides, top and bottom, affording even distribution of weight and offsetting any tendency to twist.
4. Double keyhole screw slots help in making alignment adjustments.
5. Emboss on cover, both sides and bottom, protects wires from scraping on sharp edges when being pulled through duct.



CALL IN A SQUARE D FIELD ENGINEER

If you have a problem which involves electrical control or distribution, you're welcome to the counsel of the nearest Square D Field Engineer. He is in constant contact with plants of every kind and size. He studies methods and applications with the idea of simplifying new jobs or doing old ones better.

There are Field Engineers in Square D branch offices in 52 principal United States and Canadian cities. Their services are dedicated to solving industry's war and postwar electrical problems.

SQUARE D COMPANY

DETROIT - MILWAUKEE - LOS ANGELES

KOLLSMAN INSTRUMENT DIVISION, ELMHURST, NEW YORK

IN CANADA: SQUARE D COMPANY CANADA LIMITED, TORONTO, ONTARIO

LIBRARY
COLO STATE COLLEGE
FT COLLINS COLO

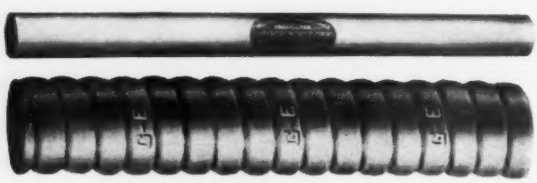
G-E CONDUIT FOR HAZARDOUS AND WET LOCATIONS

Both G-E White zinc-coated conduit and G-E Black enamelled conduit are available at G-E distributors for protecting war-purpose wiring in wet or hazardous locations. Use these high quality conduits for maintenance jobs... for rewiring . . . for new war wiring.

WPB Limitation Order L-225 permits the following uses for rigid conduit: (Type of protective coating is not restricted.)

1. In war implements such as warships, aircraft armament, tanks, etc.
2. In projects rated A-1-J or better for hazardous or wet locations (with conduit size limitations).

G-E White is hot-dipped galvanized inside and out. G-E Black is coated inside and out with a corrosion-resistant enamel. Both are leaders in their classes.



G-E FLEXIBLE CONDUIT AND EMT FOR WAR WIRING JOBS

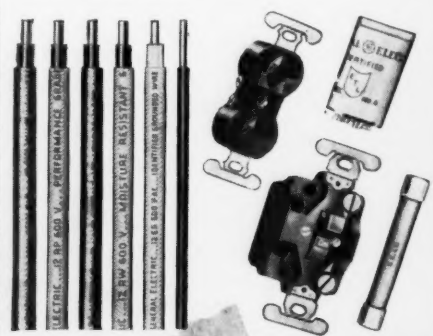
You'll like the high quality of G-E Electrical Metallic Tubing and G-E Flexible Metal Conduit. They are easy to use and will give good service. These materials can be used to protect war-purpose wiring in certain locations according to WPB Limitation Order L-225.

FOR FURTHER INFORMATION *about G-E conduits, wires and cables and wiring devices see the nearest G-E Merchandise Distributor or write to Section CDW-531-8, Appliance and Merchandise Dept., General Electric Company, Bridgeport, Conn.*

GENERAL ELECTRIC

G-E WAR-PURPOSE WIRE AND CABLE AND WIRING DEVICES

The G-E line is large. You'll find the wires and cables and wiring devices in it that you need for maintenance jobs and for new war wiring of all kinds.



UMI